SCIENTIFIC AMERICAN

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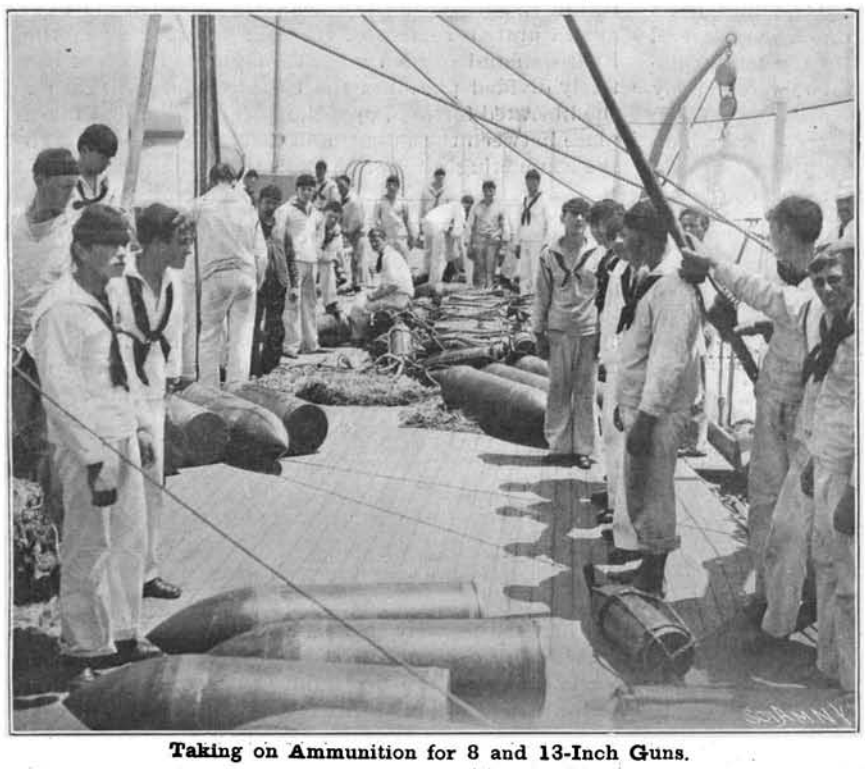

Taking on Ammunition for 8 and 13-Inch Guns.

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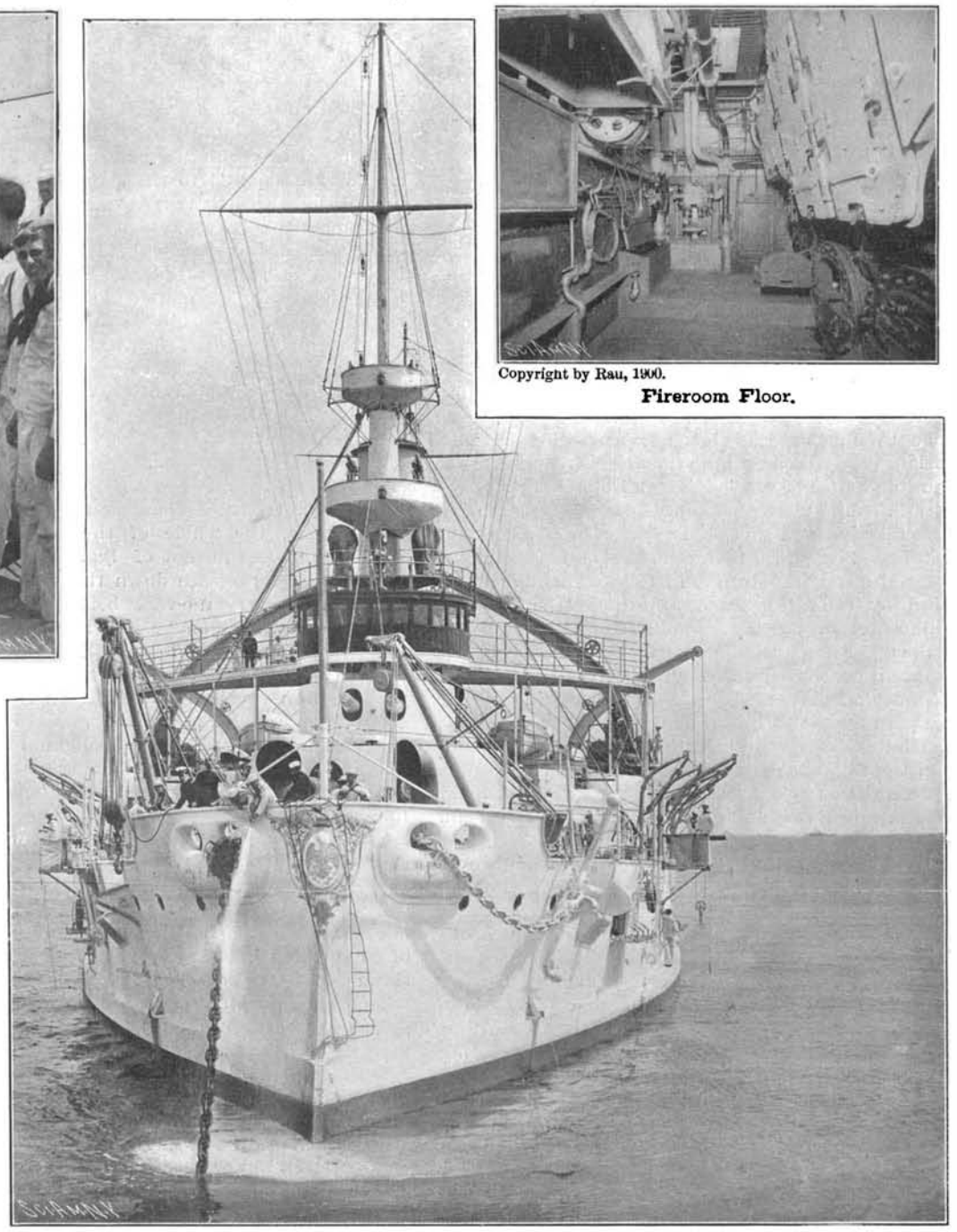
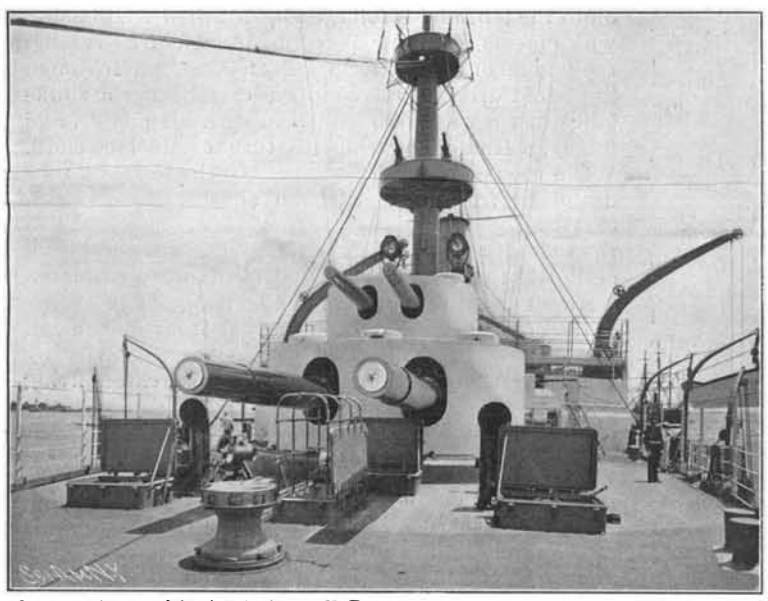
Fireroom Floor.





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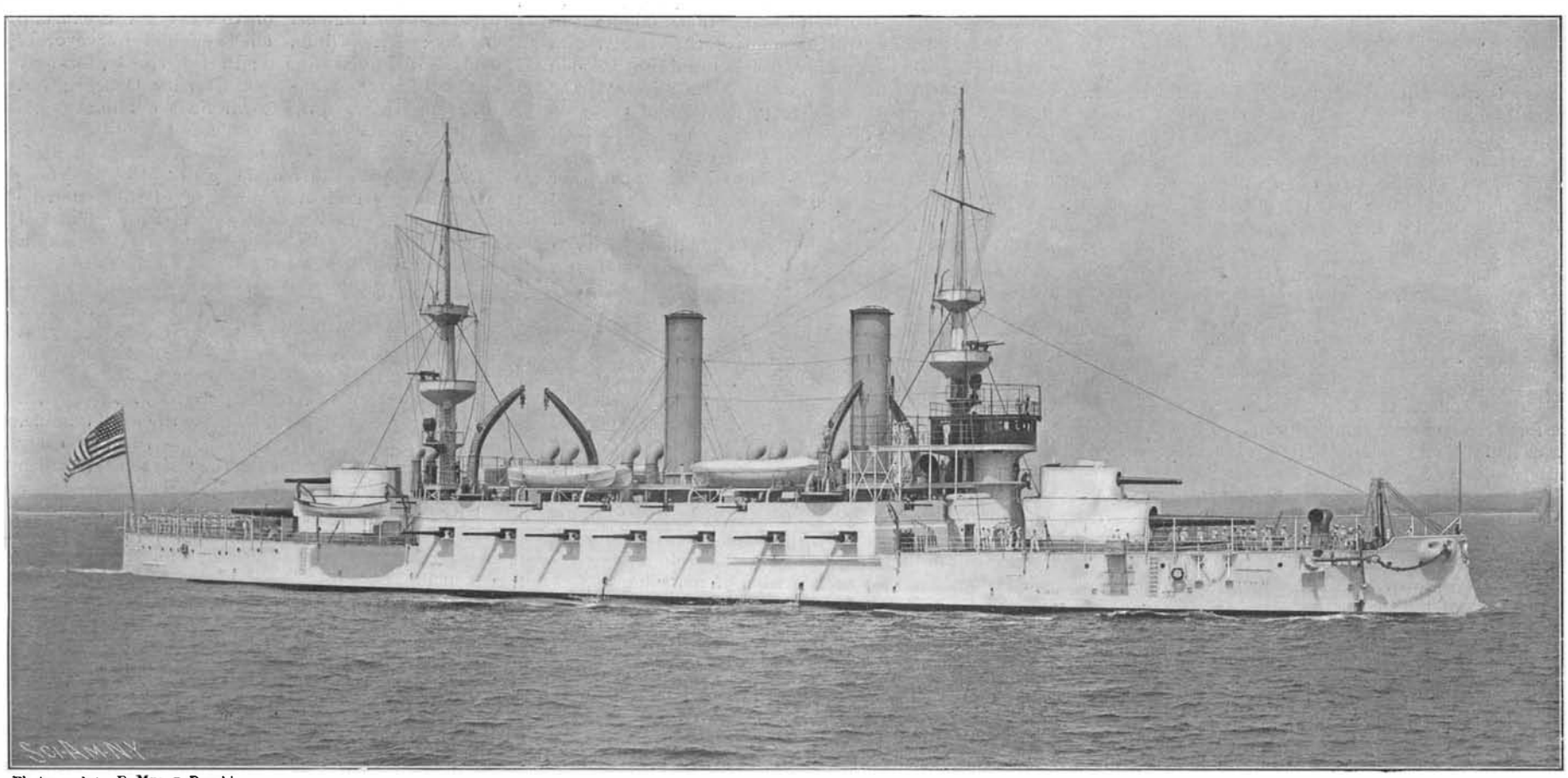
After Turret from Quarter Deck.

Photograph by E. Muller, Brooklyn.

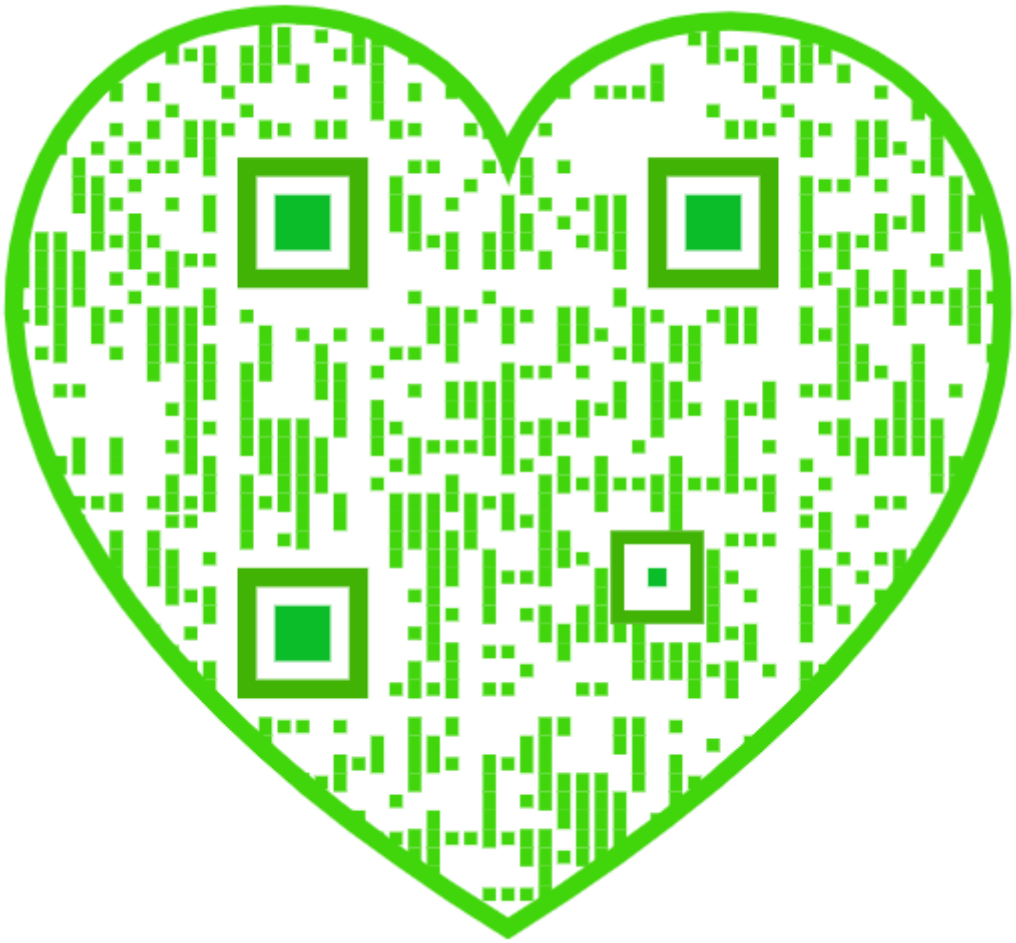
Weighing Anchor.



Photograph by E. Muller, Brooklyn.

Displacement, 11,525 tons. **Speed,** 16·9 knots. **Maximum Coal Supply,** 1,645 tons. **Armor:** Belt, 9½ to 16½ inches; turrets, 17 inches; barbettes, 15 inches; broadside battery, 5½ inches; deck, 2¾ inches flats, 3 inches slopes. **Armament,** four 13-inch; fourteen 5-inch rapid-fire; twenty 6-pounders; six 1-pounders; four Colts; two 3-inch field guns. **Torpedo Tubes,** 4. **Complement,** 520. **Date,** 1900.

UNITED STATES FIRST-CLASS BATTLESHIP "KENTUCKY."—[See page 134.]



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NEW YORK, SATURDAY, SEPTEMBER 1, 1900.

AIR RESISTANCE TO MOVING BODIES.

We publish, in another column, a letter from a correspondent who holds very pronounced views as to the exaggerated importance attached to the element of air resistance by such experimentalists as Mr. Adams, whose sheathed train, popularly known by the weird name "Windsplitter," is just now attracting much attention. Mr. Adams, whose theories have appeared so plausible to one of the leading railroad companies as to lead them to place a standard locomotive and train at his disposal and give him right of way over their main line of track, is convinced that the inertia of the air is not merely an obstacle in the way of high speed in railway trains, but that at the highest speeds it is the most serious resistance of all. Our correspondent, on the other hand, would have us believe that air resistance is greatly overrated, and that beyond the head resistance encountered by the locomotive in opening up a path for the train through the still atmosphere, the latter exerts but little retarding influence upon the following train. The truth lies somewhere between these two extremes. It is probable that Mr. Adams overestimates the air resistance—it is certain that our correspondent places it too low.

Considering how greatly it affects the problem of high-speed transportation, whether by train, trolley, automobile, bicycle, or even by those elusive phantoms, the airships and dirigible balloon, it is truly astonishing that we are possessed of so little data of a practical kind on the subject of air resistance to moving bodies. We say this with a full appreciation of the experimental work that has been done with whirling bodies and by means of gages carried upon moving trains; for, despite the facts that have been thus acquired, it is certain that they have yielded comparatively little data that is of practical value as applied to the air resistance to large bodies of broken contour and uneven surfaces traveling at high rates of speed. If our readers will take the trouble to look up a few of the treatises that have been written upon the question of train resistance, they will find that, whereas the author in each case proceeds as upon firm ground when he is speaking of wheel resistance, axle resistance, internal resistance of engines, etc., as soon as he enters the field of air resistance he moves with halting steps, as one uncertain of his foothold or moving in the dark.

There is a growing conviction among railroad men that, although Mr. Adams may be attempting to prove too much, he is opening up a question that is of far greater importance in the economics of transportation than has generally been supposed. We ourselves have long been of the opinion that if a special series of tests were to be carried out, under varying conditions, and with every refinement of scientific accuracy, to determine the exact amount of atmospheric resistance due to what we might call (adopting the language of the ship designer), the "bow wave," the "wake" and the "skin friction" of a train, the results would be as surprising as they would be valuable. If form has such an important relation to speed in a body moving through the fluid, water, it is surely not unreasonable to suppose that form has some relation to speed in a body moving four or five times as swiftly through the fluid, air. It is true, as our correspondent states, that the train carries along with it strata of air; but so does the ship carry strata of eddying water, and it is in the endeavor to reduce the speed of these currents, and so avoid the loss of power due to setting them in motion, that a "Columbia" or a "Shamrock" is sheathed with costly metal alloy and burnished to the smoothness of glass. The smoothing down of the irregularities in the surface of a train is done to reduce the velocity of these air currents and limit the air resistances mainly to those due to displacement at the engine, and replacement at the last car of the train.

Closely allied to the questions of sheathing is that of tapering the ends of a train. To what extent it would be possible to conform to the theoretical "bow" and "stern" form that would probably be suggested by the results of the proposed investigation, would be largely determined by considerations of convenience in operation.

THE ELEMENT OF SAFETY IN SMOKELESS POWDER.

During one of the violent electrical storms which recently passed over New York city, a powder boat upon which was stored a considerable amount of smokeless powder was struck by lightning, and a case containing fifty pounds of this powder ignited and its contents entirely burnt up without producing even the semblance of an explosion. Stored in the same boat, and adjacent to some of the cases which were ignited, were several kegs of black powder which, thanks to the non-explosive character of the smokeless powder, were merely scorched on the outside of the kegs.

The valuable quality of smokeless powders which renders them slow-burning and non-explosive, so long as they are exposed to the atmosphere or contained only within the slightly resisting walls of a tin can or a wooden packing case, was not the immediate object of the patient investigation which has resulted in the invention of these powders. The quality of safety is incidental to the quality of slow-burning, which is the prime requisite of all powders of this class. The common black powder, with which we are all familiar, is quick-burning; that is to say, it is converted into gas immediately upon ignition, there being practically no interval between the moment of ignition and the moment of complete combustion. If a small quantity of it is ignited in the open, it is burnt with practically explosive effect, and when it is contained in an enclosed or strongly resisting chamber such as a bore of a gun or rifle, the whole of the charge is converted into gas at the instant of ignition by the primer. The curve of pressure down the bore of the gun is consequently very uneven, being remarkably high over the powder chamber, and falling rapidly to a very low point at the muzzle. The manifest advantages of producing a powder which, as the projectile passed down the bore, would burn slowly and progressively, giving off increasing volumes of gas corresponding to the increasing space behind the projectile, led to the invention of slow-burning powders, and it is still the inspiration of all investigations along these lines.

Other things being equal, the rate at which a charge of smokeless powder will burn and be converted into gas, is proportional to the pressure to which it is subjected. A stick of powder may be held in the hand at one end, while it is burning at the other end, the rate of combustion under atmospheric pressure being very slow; but, if the same stick is burnt in a closed vessel where there is a consequent rise of pressure due to the gases which are given off, the rate of combustion will increase proportionately to the pressure.

In the remarkable incident to which we have referred, we are informed by Messrs. Von Lengerke and Detmold, of this city, the owners of the powder boat which was struck by lightning, that the corner of the cabin structures on deck was shattered, and the whole of it burst into flame. Captain Jensen, of the boat, after rowing his wife ashore, pluckily returned to the powder boat and commenced to put out the flames. While he was thus engaged on deck he perceived what he describes as a muffled sound like the blows from a succession of air waves, striking the deck beneath him, and on opening the door leading to the hold of the vessel, found that the fire had communicated to a number of wooden cases filled with five-pound tins of smokeless "E. C." powder. The pressure due to the ignition of the powder had burst open the tops of the tins and blown off the cover of the wooden packing case, after which the contents had burnt up without doing any further mischief beyond scorching the surrounding cases and black powder kegs. The incident affords a remarkable proof of the impossibility of exploding this type of powder in the shape, and under the conditions in which it is ordinarily handled, shipped, and stored.

A NEW GAS BATTERY.

A Savannah inventor, Mr. Andrew Plecher, has devised a most interesting gas battery. The generation of the current is effected by the direct chemical union of two gases—oxygen and hydrogen, for instance It is well known that certain substances, such as palladium and platinum, or other metals of this group, have the peculiar effect of causing the union of two such gases when brought together on its surface. In the "Doebereiner" lamp, for instance, where a mixture of hydrogen and oxygen impinges upon the platinum in a finely divided condition, the surface action of platinum causes the two gases to unite and to heat the platinum red hot, which in turn automatically ignites the gases. The chemical union of the two gases in such case is attended by the correlated phenomenon of heat, for the reason that the interatomic action produces a series of short circuit couples whose resistance gives heat instead of electric current.

Mr. Plecher's invention is designed to prevent this production of heat, and to get its correlative equivalent in electric current by separating the positive side of the atoms from the negative side, and by thus segregating the positive from the negative forces to carry them off in an extraneous circuit which permits it to be used in a controllable electric circuit. Briefly, the invention consists in a cell whose body structure is of some porous material which is homogeneously filled throughout the entire structure with platinum, or its equivalent in a finely divided condition. This cell body has brought to its surface on one side one of the gases, and on the other side the other gas, and the cell is provided with two gathering electrodes of great superficial extent, one of them bathed in the hydrogen-saturated surface of the cell and the other in the oxygen-saturated surface of the cell, whereby when the hydrogen and oxygen unite through the action of the finely divided platinum the two electrodes will gather the liberated forces of opposite polarity as union takes place between the atoms, and carry them off through the conducting wires of an extraneous circuit.

AN INTERESTING CLOCK.

Messrs. William Potts & Sons, the well-known clock makers of Leeds, England, have just constructed for that city what is claimed to be the greatest horological achievement of the century. The clock is a huge one, and in it are combined many features of the most remarkable clocks in the world, such as those at Berne and Strasburg Cathedral.

The huge clock dial, which is of polished copper with the figures inscribed upon it in blue, is flanked upon either side by a mail-clad knight, each holding above his head a battle-axe, which serves to strike the gongs at the quarters and hours. Above the clock, upon a kind of perch, stands a large cockerel. In front of the dial is a platform.

When the quarters of the hour are reached the mail-clad knights strike their gongs. Immediately on the left hand side of the dial a door opens automatically, and there issues forth a British soldier in full uniform. When he reaches the center of the platform he halts and salutes in precise military manner. He then passes on to the left, and is followed by a kilted Highlander, who repeats a similar performance when he reaches the middle of the platform. Then comes an Irishman in the old dress of his country, brandishing a shillelah; then a Canadian boatman with his paddle, and finally, a Hindoo, wearing his turban and loin cloth. When the figures have passed round the platform they disappear from sight through another door, which closes automatically upon the last figure's exit. Then the cockbird overhead flaps its wings, raises its head, and gives three lusty crows. The figures are manufactured of copper bronze, while many of the other parts of the clock are constructed from gun metal. The escapement is the double three-legged gravity by Lord Grimthorpe, who is probably the greatest living authority on clocks and bells.

INQUIRY CONCERNING WATER TUBE BOILERS.

The British Admiralty are going to hold an exhaustive inquiry in connection with the respective advantages of the water-tube boiler and the cylindrical boiler as used in the British Navy. The committee consists of seven members: Vice-Admiral Sir Compton Domville, president, who has had under his command vessels equipped with both types of boilers; Mr. List, the superintendent engineer of the Cunard Steamship Company; Mr. Milton, chief engineer-surveyor of Lloyds Registry of Shipping; Prof. Kennedy, formerly professor of engineering at University College; Mr. Smith, an engineer in the Royal Navy holding the position of inspector of machinery; and another gentleman whose name is not yet divulged. The committee will ascertain, practically and experimentally, the relative advantages and disadvantages of the Belleville boiler for naval purposes as compared with cylindrical boilers; will investigate the causes of the defects that have occurred in these boilers, and in the machinery of ships fitted with them. The committe will then report as to how the defects may be remedied, or averted altogether, and will also report upon the other types of machinery employed in the vessels. In short, the committee of inquiry will completely overhaul all the various types of machinery employed in the British Navy, and then report as to which is the most reliable, trustworthy, and efficient. To enable them to carry out their practical experiments, the "Hyacinth," which is supplied with water-tube boilers, and another cruiser fitted with cylindrical boilers, will be placed at their disposal. Copies of the reports of all the defects of machinery and boilers that were developed during the recent maneuvers of the Channel Squadron will be handed to the committee, and they will inspect the vessels in which the accidents occurred.

THE question of the gender of the word "automobile" has just come up for adjudication by the French Academy and the "Immortels" have decided to make it masculine. Many French purists disagree with the Academy. Still it seems eminently proper to make the rattling combination of iron and fire, or electricity, masculine.

THE HEAVENS IN SEPTEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

The shortening days of September bear witness to the sun's continued southward progress. On the morning of the 23d the sun enters the sign of Libra, and, in the language of the almanacs, "Autumn begins." With the change of season it is as well to take our monthly glance at the stars at an earlier hour—9 P. M. in the middle of the month.

Right overhead is Cygnus, with Aquila on the south along the Milky Way, and Sagittarius setting below. Lyra is west of the zenith, and Hercules, Corona, Boötes, and Ophiuchus fill up the western and northwestern sky. The Little Dipper extends horizontally to the left of the pole, and the Great Dipper is just below it.

Due south of Cygnus, and east of Aquila, is the little lozenge of Delphinus, or "Job's Coffin." Capricornus and Aquarius are to the south and east, and low down on the southeastern horizon the solitary first-magnitude star Fomalhaut marks the constellation of the Southern Fish. Aries and Pisces are low in the east, and the Pleiades have just risen. Higher up is the brilliant array of Pegasus, Andromeda, and Perseus, and far to the northward Capella is once more visible.

THE PLANETS.

Mercury is morning star till the 13th, when he passes superior conjunction and becomes evening star. He is too near the sun during the month to be well seen with the naked eye.

Venus is by far the most conspicuous ornament of the morning sky, rising before 2 A. M. all through the month. On the 16th she reaches her greatest eastern elongation. Though past her time of greatest brightness, she is still very brilliant, and can be easily seen in the daytime when properly pointed out. At noon on the 19th she is about 3° due north of the waning crescent moon, and should be easy enough to find.

Mars is a morning star in Gemini, rising about 1 A.M. in the middle of the month, but is not yet conspicuous. He is less than 10° west of Venus on the 1st, but since Venus is moving eastward much more rapidly than he is, the distance increases to over 20° during the month.

The presence close together in the morning skies of the two planets which are nearest our own may furnish occasion for speculations about their possible habitability.

Far as we are from any definite conclusion on the subject, it is interesting to note that the results of certain recent investigations seem to reverse generally accepted notions by indicating that forms of life similar to those of the earth might have a better chance of surviving on Venus than on Mars.

Among the conditions evidently essential for such a survival are, first, a rotation of the planet sufficiently rapid to avoid overheating by day and undue cooling at night; second, the presence of an atmosphere and of water; and, last but not least, a mean temperature of the planet's surface between the freezing point and about 150° Fahrenheit.

The first of these conditions is fulfilled for both planets, as has long been known in the case of Mars, and as the recent spectroscopic work of Belopolsky proves in the case of Venus.

It has recently been shown that the density of the atmosphere of Venus at her visible surface is much less than that of the earth's at sea level. But if, as is often supposed, the visible surface of Venus is a continuous layer of clouds, the lower layers of her atmosphere beneath this veil may be as dense as the earth's, or even much denser; and such extensive clouds imply abundant water.

The atmosphere of Mars, on the other hand, is shown by spectroscopic evidence to be very much less dense than the earth's, and there are very few, if any, clouds in it.

But the most important of the recent investigations in this connection deal with the question of temperature.

Venus receives twice as much light and heat from the sun as does the earth and Mars less than half as much as the earth. A part of this light and heat is reflected by each of the planets, and does not warm it. The rest is absorbed, warming the planet, and is then slowly radiated into space again. The rate at which this radiation takes place depends upon the planet's surface temperature according to a known law, so that, if we know the amount of heat that the planet absorbs and then radiates, we can attain a fair approximation to its surface temperature.

Now, it has been determined that Venus reflects 60 or 70 per cent of the light falling on her, and, consequently, absorbs from 30 to 40 per cent, and that Mars reflects about 25 per cent and absorbs 75 per cent; and it is estimated that the earth reflects about 30 per cent and absorbs about 70 per cent.

So, taking the amount of heat received by the earth from the sun as a unit, we find that Venus absorbs 30 to 40 per cent of twice that amount, or from 60 to 80 per cent of the unit.

The earth absorbs 70 per cent of the unit, and Mars 75 per cent of less than half a unit, or about 35 per cent of a unit. So it appears that Venus and the earth have about equal amounts of heat to radiate, while Mars has only half as much. This makes it seem probable that the surface temperatures of Venus and the earth are about the same, while that of Mars is much lower—about as cold at its equator as at the earth's poles.

Of course, the internal heat of the planets may warm their surfaces up to any degree. But in its absence it can hardly be doubted that the earth's surface is much warmer than that of Mars.

The character of the true surface of Venus, below the supposed cloud layer, must, of course, remain a matter of conjecture. But it is to that hidden region, rather than to the ruddy planet, that in the present state of our knowledge our imagination is directed in the search for a possible inhabited world.

Jupiter is in Scorpio, and is being rapidly overtaken by the sun, so that he is only visible in the early evening. Saturn is in Sagittarius, and remains visible in the southwest about an hour and a half longer than Jupiter. Uranus is in Scorpio east of Jupiter, and Neptune in Taurus, very difficult to find without a telescope provided with circles.

The comet discovered late in July by Prof. Brooks is still in sight. Toward the end of August it passes close to the pole, and is visible all night long, but is too faint to be seen with the naked eye and is growing fainter, as it is receding from both earth and sun.

THE MOON.

First quarter occurs on the night of the 1st, full moon on that of the 8th, last quarter on the afternoon of the 15th and new moon on that of the 23d. The moon is nearest the earth on the 9th and most remote on the 23d. She makes an unusual number of conjunctions with the planets during the month, passing Jupiter on the afternoon of the 1st; Uranus the same night; Saturn on the afternoon of the 3d; Neptune on the morning of the 16th; Mars on that of the 18th; Venus at noon on the 19th; Mercury on the afternoon of the 24th; both Jupiter and Uranus again on the morning of the 29th, and Saturn on the night of the 30th.

POLYGLOT CHINA.

It is true, says the Ostindischer Lloyd, that the inhabitants of Peking, Canton, Shanghai, Futwa and Amoy speak Chinese; but, as to other parts of the country, it is also true that citizens of the places named cannot understand the inhabitants any more easily than can a Parisian a German. Thus, the position of the Chinaman in his own country, where various so-called dialects are spoken, is rather peculiar. The Chinese dialects have nothing in common with the patois, or conversation forms of the language. They are used by the highest and lowest classes, the savants and the uneducated, and the officials and the coolies. The dialect is a language of itself. The various dialect forms are related to one another in somewhat the same manner as the Arabic to the Hebrew and other Semitic tongues, or German to English, Dutch, Swedish, etc.

If it is desirable to classify the numerous dialects, they may be divided into the Canton, Hakka, Amoy, Swatow, Shanghai, Nifigho, Hainanese and Mandarin. The youngest of these is the Mandarin. This dialect is not, as generally supposed, the universal language of China. The Canton tongue resembles the ancient Chinese spoken 3,000 years ago more closely than does the Mandarin. The Hakka also shows traces of great antiquity. It is much older than the Mandarin, and almost equals in point of age the Canton tongue. The same may be said of the Swatow, Amoy and Shanghai dialects. In general, it may be said that the languages spoken in southeastern China show traces of the ancient Chinese tongue, while the Mandarin dialect is modern.

In addition to these main divisions, there are many quasi-dialects spoken, in some instances, by thousands of people. But the same word forms or dialects are not used by all persons in a single district, although the districts (civic divisions) are, as a rule, much smaller than those of the countries of western Europe. People only a few miles distant from each other often use totally different dialect forms. In some of the large cities, such as Canton, with more than 1,000.000 inhabitants, we often find several dialect forms in use. The variations in the Chinese tongue are so great, indeed, that it is not too much to say that there are as many dialect forms in the Flowery Kingdom as there are days in the year.

The most widely spread language is the Mandarin, which is used in one form or another in fourteen or fifteen of the nineteen provinces forming China. There are also northern and southern Mandarin tongues. The best northern Mandarin dialect is spoken in Peking, while the best southern is spoken in Nankin. A third marked form of the same tongue is spoken in West China, especially in Tsien-Kiang. People who speak the various Mandarin dialects, however, can readily understand one another. All persons, from whatever part of China, who desire to enter political or official life, learn this tongue.

The other Chinese languages are spoken by comparatively small numbers of people. About 20,000,000, for instance, speak Cantonese in one form or another. It is used in the greater part of the province of Quang-Tong. About one-third of the people of this province use the Hakka tongue. In its northeastern part, the Swatow dialect is also heard. Cantonese is also spoken in the Quang-si provinces. There are not so many dialectic forms of the Hakka tongue as there are of the Cantonese. Passing up the coast, we find about 3,000,000 people speaking Swatow. In all probability, 9,000,000 use the Amoy dialect, which resembles Swatow about as closely as Portuguese does Spanish. Still further up the coast, we find the Futwa dialect, which is used in a district about 150 miles long and 300 wide, containing a population of 5,000,000. The dialects of Ningho and Shanghai, although only a few miles apart, differ greatly. The Hainanese is spoken by the people of Hainan. It is related to the Amoy and Swatow dialects—slightly resembling the Japanese—and is spoken by about 3,000,000 people. The inhabitants of the vicinage of Sutshu, between Japan and Formosa, also speak Hainanese.

The official language of China is the Pekingese (a Mandarin dialect), which is spoken by 200,000,000 people. The Court has to have interpreters.

All the Chinese who come to the United States are from Canton and its near neighborhood, and consequently speak the Cantonese dialect.

The Chinese are not generally educated. About one man in every hundred can read and write, and about one out of a thousand women.

Foreigners can seldom do more than learn one dialect in a lifetime. To speak one dialect, it is necessary to know at least 6,000 words. One well-known translator of the Chinese classics did not speak enough words to be understood by his Chinese servants.

THE DEATH OF PROF. J. E. KEELER.

The death of Prof. James Edward Keeler, Director of the Lick Observatory, at Mount Hamilton, on August 12, is an irreparable loss to that branch of science of which he was so conspicuous an ornament.

Born in La Salle, Illinois, forty-three years ago, he early manifested an inclination toward astronomical research. A graduate of Johns Hopkins University, he at once entered upon the practice of the profession to which he had determined to devote his life. In 1878 he participated in the Colorado expedition for observing the total eclipse, and was afterward a colleague of Prof. Langley in the famous expedition to Mount Whitney in California.

Later he studied with Quincke, at Heidelberg, and Helmholtz, of Berlin, and on his return attached himself to the Allegheny Observatory as assistant. When Prof. Langley retired from Allegheny, Prof. Keeler took his place as chief astronomer. Under his direction that observatory gained its highest position among astronomers in the field of original discovery, Prof. Keeler devoting his special talent to the advancement of the science of stellar spectroscopy, and achieved great fame for his discoveries in this abstruse and difficult branch. In 1898 he was chosen Chief Director of the Lick Observatory, and under his capable management the powers of its great instrument were devoted to the highest uses.

Prof. Keeler, while an enthusiast in his favorite science, was at the same time extremely conservative. The ambition to shine in popular estimation was entirely lacking; consequently, the work which he accomplished can be truly estimated only by the great ones in astronomy who work less for sensational applause than for established results.

Prof. Keeler's researches on the sun were profound and successful, and his lectures, given from time to time before the academical societies of the West upon this subject, were remarkable for their lucidity and brilliant conclusions.

Prof. Keeler's chief claims to distinction were based upon a work—not yet complete—of studies of nebulæ, from which much was hoped for. His observations upon the great nebulæ of Orion, published in the SCIENTIFIC AMERICAN of May 13, 1899, gives an impression of the scope of a work which was designed to distinguish the new epoch in astronomical research.

AWARDS AT THE PARIS EXPOSITION.

Forty-two thousand seven hundred and ninety exhibitors out of 75,531 have received awards at the Paris Exposition. The United States obtained 1,981 awards, of these 220 were grand prizes, 486 gold medals, 583 silver medals, 422 bronze medals, 270 honorable mentions, and a long list of gold, silver and bronze medals of collaborators. In the last Exposition only 1,000 prizes, including those for collaborators, were given. The prizes were as follows: Grand prizes, 55; gold medals, 214; silver medals, 300; bronze medals, 246; honorable mentions, 229. The names of those who received grand prizes or gold medals have been made public.

LOCOMOTIVE SNOW PLOWS IN EUROPE.

Owing to the heavy snowfalls during winter the lines in central Europe are greatly interfered with in their traffic; in the north of England, the running of trains is often interrupted during the first fortnight of February; and in Scotland a passenger train, blockaded by snow, sometimes has to stop in the open country for an entire night.

This has called attention to the measures to be taken to prevent railway tracks from becoming buried under snow as the result of severe storms.

At present we have fences, and small masonry walls, or what are called "snow fenders"; and also snow barriers, such especially as those used upon the Cape Cod section of the New York, New Haven and Hartford Railroad. In Saxony, still another arrangement has been devised to prevent the accumulation of snow upon rails and in cuttings. This consists of finely meshed nets of iron wire, expanded metal (metal deployé), or even of cocoa fiber, which have interstices of about 1¼ inches and are strung in lengths of 13 feet by 5 feet in height. They are fastened at the top and bottom to ropes stretched between poles, similarly to a tennis net. Old railway ties often serve as the poles. This net opposes no obstacle to the wind, although it perfectly arrests the snow.

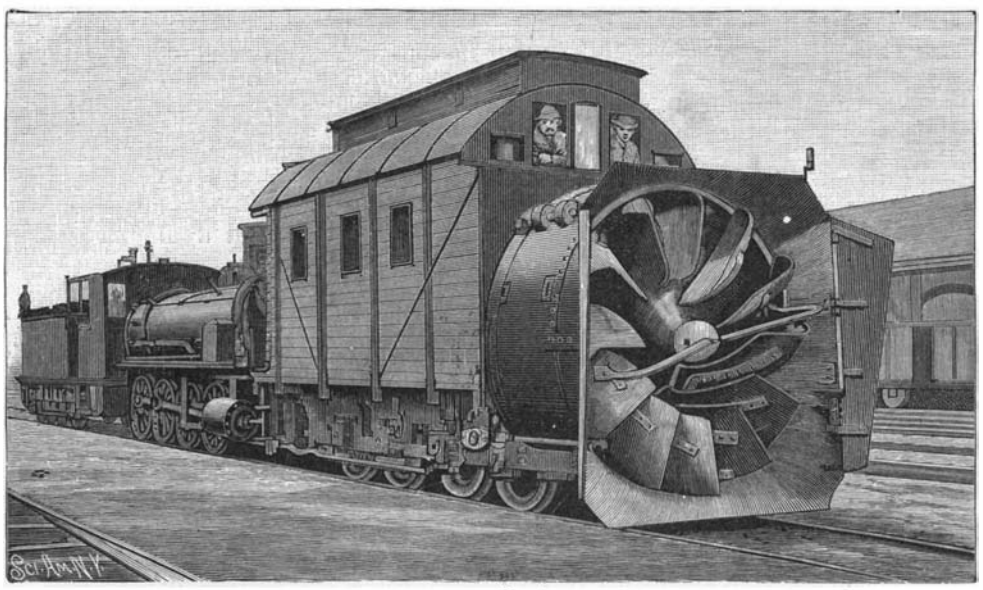
When the means of protection are unable to resist the snow, plows of the common type are mounted temporarily upon the locomotives. These attachments may be dismounted when it is so desired. They do very effective work at a speed of 24 miles an hour, when the snow does not exceed a depth of 20 inches. But if the heaps of snow are unmanageable, cover everything, and fill up in the cuttings, recourse has to be had to more powerful means, to the centrifugal snow plow, a machine invented in the United States by Mr. Rocca as long ago as 1887, and subsequently improved.

The most important part of this snow plow is a vane-wheel, mounted on a shaft, driven by a twin engine, the cranks of which are placed at right angles to each other.

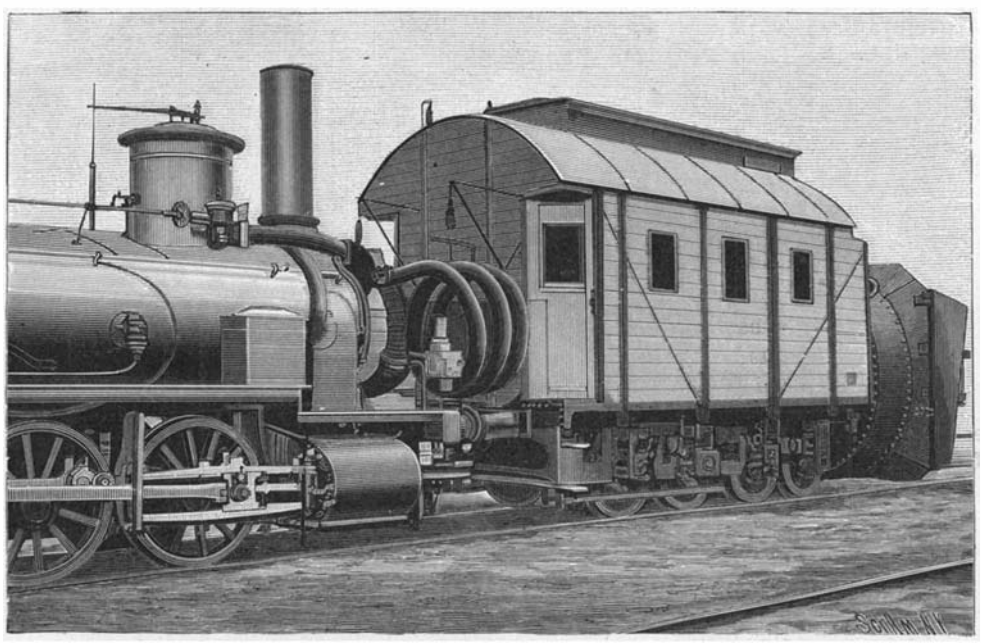
An iron bar screwed to the head of the shaft, the two ends of which are secured to two of the blades, serves to break up the snow. The rapidly rotating vanes collect the snow and hurl it across a skirt secured to the periphery of the drum containing the wheel. The skirt can be vertically inclined to an angle of 45°. The engine is constructed for an effective pressure of 150 pounds. The diameter of the cylinder and the length of the stroke are both 22 inches. The bladed wheel has a maximum speed of 180 revolutions per minute. Steam is supplied from the locomotive by a coiled copper pipe. Another pipe of similar form permits part of the steam to escape from the cylinders of the engine used in driving the plow, and pass out of the exhaust in the smoke-box of the locomotive. A steam pipe, branching from the main pipe, enters the drum and melts the accumulation of snow, which would tend to clog the machine.

Tests made on the Hungarian lines showed that freshly fallen snow not more than 7 feet high can be easily cleared away. The trajectory described by the discharged stream of snow is 150 feet long and 50 feet high. If the skirt is inclined 60° the height of the trajectory is 65 feet; but the distance is reduced to 100 feet.

The consumption of steam is great; the locomotive can furnish the necessary amount only for ten minutes at a time, and must then stop to generate a fresh supply. When the snow is more than 7 feet high, it is often necessary to use two or even three locomotives; under these conditions steam can be furnished only for five minutes at a time, by the locomotive used for the purpose.



FORM OF ROTARY SNOW PLOW USED ON HUNGARIAN RAILROADS.



REAR VIEW OF PLOW, SHOWING COILED COPPER STEAM PIPE.

German Hydraulic Plant.

One of the most recent of the German hydraulic plants is that which has been erected at Marbach, utilizing the force of the Neckar. The station will give 400 horse power at low water and 1,100 at average level. Four turbines of 13½ feet are used, placed side by side; the height of fall varies from 8½ to 10 feet. The turbines have been made at the Voth factory, of Heidenheim, and the electrical apparatus by the Schuckert Company, of Nuremberg. To each turbine is connected directly an alternate current dynamo giving 11,000 volts. The electrical energy is transmitted to Stuttgart, a distance of 12 miles, mainly by overhead conductor, which extends as far as Prag, where a sub-station has been established; the tension is reduced from 10,000 to 3,000 volts, and two cables lead to the second sub-station of Stockach and to the main station in Marienstrasse; in both the latter a part of the alternating current is transformed to direct current.

Chronic Brass Poison.

Metallic poisoning in its various forms is quite frequent in certain industries. It is specially common in those employed in lead works and with painters who use lead colors. Those who use hair dyes and cosmetics containing lead also frequently suffer, and water passing through new lead pipes also is responsible for some cases. Other forms of metallic poisoning are less common. Copper poisoning is not generally observed, although it may occur in those engaged in operations in which either the metal itself, or its alloy with zinc, namely brass, enters. A study has been made of this condition as it occurs among artisans in brass in Birmingham, England, and The Medical Record recently contained an editorial upon the subject, from which we glean the following:

The patient is likely to be a young workman, presenting a more or less markedly anxious expression, with a thin and haggard face, a sallow complexion and an unhealthy and wasted appearance. He complains of gradual loss of strength, of a dry and hacking cough, and cold sweats, pain in the chest, loss of appetite, and progressive emaciation in addition raises a suspicion of pulmonary tuberculosis. The nature of the disorder is not clear, and treatment fails to give relief. An examination of the teeth shows a typical green line, probably due to deposition of copper. As the disease progresses emaciation becomes conspicuous, with loss of strength and tremor. Headache is almost always present, as well as neuralgia. As a rule, digestive disturbances are present, with loss of appetite and occasional nausea and vomiting. There may be a dry, tickling cough. Symptoms of catarrh are not uncommon, and there is a sense of dryness or discomfort or contraction in the throat and a metallic taste. A feeling of oppression or nervousness, sometimes intense, is common, also repeated attacks of faintness and sinking in the morning or at work. There is profuse perspiration, staining the linen, the hair is green, and there also are many other bad features of the disease, but phosphorus pills and dilute phosphoric acid yielded satisfactory results. The use of milk as a beverage was found to be of distinct advantage.

Utilization of Sugar Beet Waste as Manure.

No satisfactory process has been found until recently for utilizing waste materials which accumulate so rapidly in German beet sugar factories. The problems which were the most difficult to solve were how to reduce to a useful form the valuable ingredients remaining in the mass, how to obviate the unpleasant odors, and to dispose of the dangerous waste water. These difficulties were particularly felt in establishments which produce sugar or alcohol from molasses, the residuum, known as brown lye or molasses dregs, being a waste substance which it was found difficult to dispose of satisfactorily. When emptied into rivers, through sewers, it resulted in the death of fish. When the lye was reduced chemically the products of combustion escaping from the chimney made offensive odors in the neighborhood. It was found that the manuring of fields with waste materials of this sort is advantageous because the soil thus receives back in easily assimilable form useful matter of which the beet deprived it in its growth, especially potassium and nitrogen. This molasses lye cannot now be conveniently used with manure, owing to the large quantity of water which it contains, which makes its transportation too expensive. It cannot be used in its concentrated form on account of its inconveniently stiff and sirupy form. A process has been invented which obviates all the difficulties named above. Molasses lye is changed into a dry substance, which can be stored and eventually easily scattered over the field.

The United States consul at Magdeburg states that a recent issue of The Hanover Journal of Agriculture and Forestry gives the following analysis of the product: Nitrogen, 3·22 per cent, of which 2·74 per cent is nitrogen soluble in water (of this 0·7 per cent is ammonia nitrogen and 0·09 per cent saltpeter nitrogen); phosphoric acid, 0·13 per cent, of which 0·04 per cent is phosphoric acid soluble in water; potash (soluble), 10·74 per cent; carbonate of lime, 25·99 per cent.

The value of the manure is 3·05 marks (72·59 cents) per centner (110 pounds). It is said that molasses sugar refineries and molasses distilleries will be able to secure higher net profits from this manure than now result from the manufacture of saline and potash, and that the process is of considerable value from a hygienic standpoint. The inventor believes that the application of the process can be extended to waste materials of other industries, and perhaps also to sewage matter.

English Red.

Iron oxide is a material of considerable importance, though not wanted in very large quantities, as a polishing agent for glass, etc., and also as a coloring matter. It is not used in the pure state, but the admixtures and impurities must be restricted to within certain limits. It is a bye-product from the manufacture of sulphuric acid, alum, and of vitriol from pyrites. Hardness and fineness are the chief requisites. In testing such natural or artificial preparations, the substance is not further ground, but dissolved in hydrochloric acid, and the iron, aluminium, calcium, magnesium, and copper contained in the filtrate are determined. The residue is essentially silica; further mica, quartz, feldspar, substances which can be distinguished under the microscope, and which give clues as to the origin of the material. Good English red is an expensive substance, and should contain a high percentage of iron oxide, 90 per cent and more. No hard impurities can be tolerated.

A New Fruit.

A new fruit was recently exhibited to the Fellows of the Royal Horticultural Society, in London. The plant bearing it is a hybrid between the raspberry and the common blackberry. The taste of the fruit combines the flavors of the dewberry with that of the raspberry, and it comes into bearing as the raspberries are failing.

THE SILK-PRODUCING SPIDER OF MADAGASCAR.

Some very interesting experiments have just been made at the Professional School of Tananarive with a view to rendering practical to a certain degree, the utilization of the thread of the silk-producing spiders indigenous to the great island of Madagascar. Visitors to the Exposition will have an opportunity of seeing specimens of the splendid fabric manufactured from this material. Some dithyrambic articles have already appeared in the Parisian papers announcing to the public at large a new industry—that of "araeiculture," destined to take a place alongside of sericiculture.

"The spider, the ugly spider is preparing marvelous riches for us. . . . Tananarive is going to dethrone Lyons. The banks of the Rhone are no longer to be the only ones to rear silk producers, for the Imerina already counts her own." It is well to reduce things to more modest proportions, and I am going to present them in their true light.

The author of the article that I have just cited says himself that the "Halabé" (as the Malagashes call the silk-producing spider) is quite difficult to reproduce, since the female, which alone yields the thread, is so ferocious and ravenous that the male cannot approach her except with the greatest precaution, and not until after he has assured himself of her feelings; for, in most cases, she kills and eats him. So these insects multiply only in certain favored places, such as the extensive woods of mango trees of the royal gardens in the vicinity of Tananarive, where they do not devour one another, since they are there assured of an abundance of food.

Under such unfavorable conditions it is almost impossible to hope for an unlimited artificial rearing, as with the silk worm, and it seems to be inevitable that we shall have to confine ourselves to an exploitation of the spiders that live in these privileged localities, taking care not to decimate or destroy them. This simple exposé suffices to demonstrate that it is impossible to count upon the utilization of these arachnids as a genuine industry. Nevertheless, we may hope, from the experiments made, to derive a certain advantage, on a small scale, in having for our objective only the manufacture of exceedingly rare and valuable fabrics.

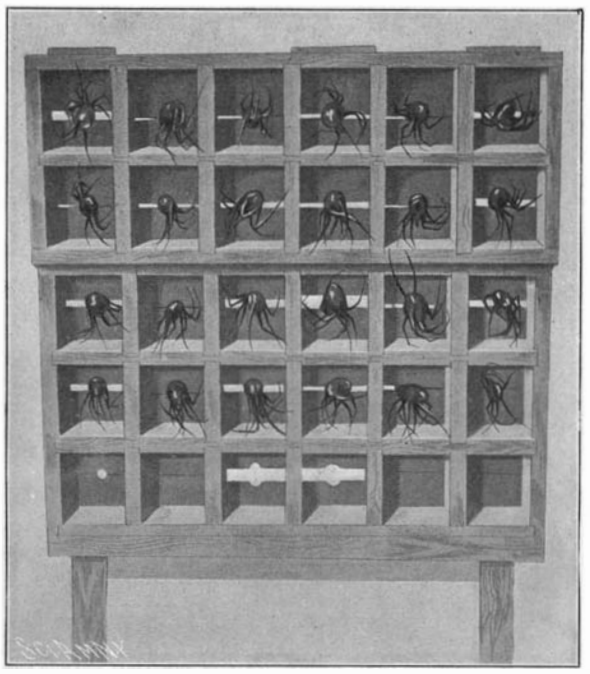
At the beginning of last winter I visited the Professional School of Tananarive founded by General Gallieni in the old palace of the queen and its adjoining buildings. This institution will prove one of the most fruitful of the General's works in Madagascar, if its directors are able to maintain it in the eminently practical way that has been traced out for them. The young Malagash pupils attend the lectures with the greatest assiduity, and they and the professors and monitors vie with each other in zeal.

During the course of my visit, I had an opportunity of seeing the operation of reeling the silk from the spider performed under my eyes, and was enabled to photograph the different phases of this very curious process. In the first place, the spiders are brought from the country in light baskets by Malagash women on the very day upon which the silk is to be reeled. It is important, in fact, that they shall be left shut up together for but a short time, since they have an unfortunate habit of devouring one another, and the risk would be run of eventually finding nothing but the single survivor! The operator then proceeds as in reeling silk, that is to say, he unites several threads and twists them at the same time that they are reeled, so as to produce a thread of the desired size.

As for the spiders, they are placed in a frame in groups of one or two dozen. It is important not to mutilate or wound them during the operation, since they are capable of being submitted to four or five successive reelings in a month, representing about four thousand yards of thread. At the Professional School of Tananarive the idea has occurred to place the spiders in what are called "guillotines," the crescents of which hold them between the abdomen and corselet. Their legs are turned back upon the corselet and their abdomen emerges from the side on which the unwinding and twisting of the thread is done. The Malagash girls, in performing this delicate operation, touch the end of the abdomen of the prisoners with the finger and then gently withdraw the latter, thus carrying along, in a single bundle, the twelve or twenty-four threads to a hook that unites them into a single one, whence they afterward start for the bobbin upon which they are to be wound.

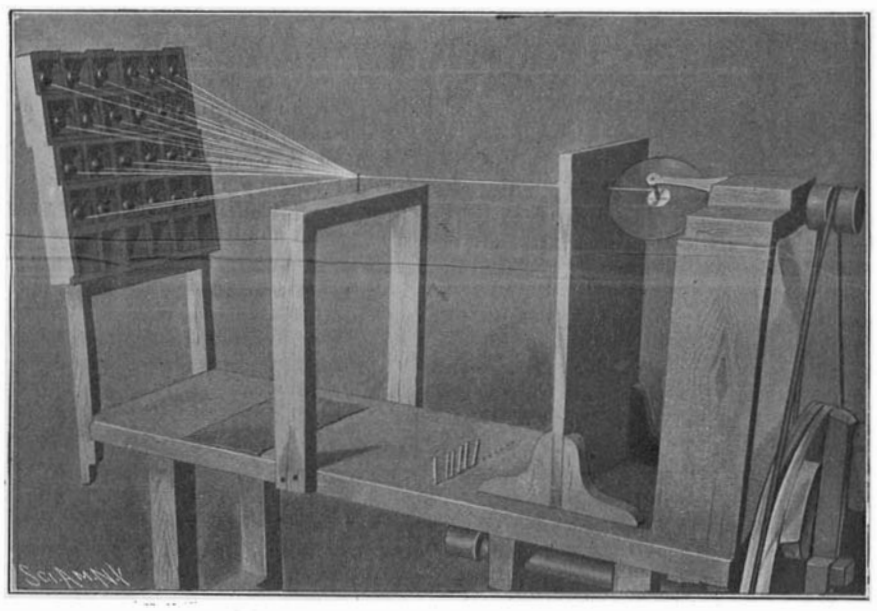
In order to effect the reeling and twisting of the thread at the same time, an ingenious system has been devised that gives excellent results.

The spiders thus undergo a complete reeling without resistance, and when they are "empty" they are replaced by others. Those which have been operated upon are placed for convalescence in a "park" constructed for the purpose and consisting of bamboo planted in the ground and connected by strings so as to form trellises. After a few days' rest in these, those that have not been devoured are taken out in order to be submitted to another reeling.

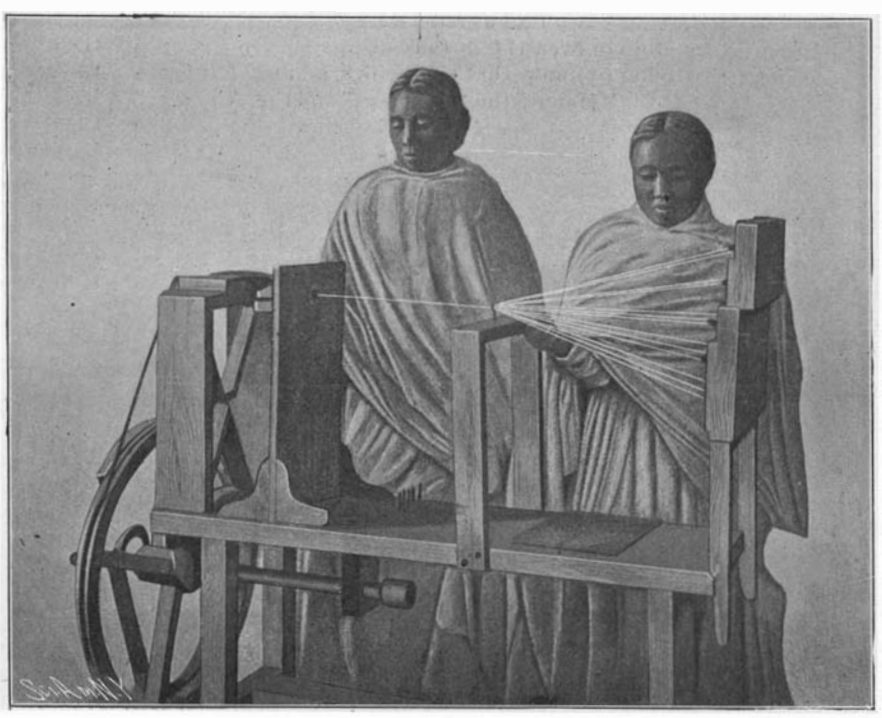


SPIDERS IN THE GUILLOTINE REELING-BOXES.

The silk of the Halabés is of a wonderful color. A thread of gold could not be more brilliant nor of a purer yellow; but no attempt has been made to wash these threads prior to their being woven, as is done with silk worm threads, and perhaps such washing might remove this brilliant natural color. But there would remain the tenuity, elasticity and tenacity, which, it is said, are much superior to those of ordinary silk; and this would permit of the manufacture of wonderfully fine fabrics of extreme flexibility and of a strength destined to defy ages.



THE REELING APPARATUS.



THE OPERATION OF REELING.

The merit of this original discovery is due to Father Camboné, a Catholic missionary in Madagascar, who was the first to endeavor to turn the thread of the silk-producing spider (Nephila Madagascarensis) to account. Like the Malagashes, he contented himself in the first place with collecting the innumerable webs of the spiders that abound in the gardens of the Mission, and in carding and spinning them. He wove fabrics that were absolutely unwearable and of a coarse aspect, owing to the irregularity of the threads. He then endeavored to improve his thread by reeling it directly from the abdomen of the spiders, which he inclosed in match boxes, and was thus the inventor of the process now employed at the Professional School of Tananarive. Nevertheless, it appears that Reaumur attempted the reeling of the threads of living spiders in 1710, in operating upon the Epeïræ of France, arachnids of small size, of which, according to his calculations, it would require 700,000 to yield a pound of silk.

But I doubt whether the echo of such researches ever reached the ears of Father Camboné at Madagascar, any more than the experiments of Raimardo Maria de Tremayer in Spain or of Alcide d'Orbigny in America; so, we may, without injustice, allow the good Father all the merit of his discovery. It is, therefore, to him alone that the traveling spiders which the government is going to send from Madagascar to Paris on board of comfortable packet boats of the Messageries Maratimes, for operating before the international eyes of the visitors to the Exposition, will have made this glorious trip. Thanks to him, they will become acquainted with the mildness of our climate and the succulence of the French flies that will be officially served up to them at their meals.—G. Courtellemont, in Le Monde Illustré

Process for Preserving Wood.

Mr. Fritz Hasselmann has invented a process for preserving wood. It is called the xylosete process, and consists in boiling the wood in a solution of metallic and mineral salts, under a pressure varying from 15 pounds to 40 pounds per square inch. The solution is composed of the sulphates of copper and iron crystallized together in the proportion of 80 per cent of copper and 20 per cent of iron, alumina, and a salt which is mined at Stassfurt, in Germany, called "kanit." This latter chemical is a compound of sulphate of potash and magnesia and chloride of magnesia. The properties that this solution exercises upon the woods so treated are the withdrawal of the sap and its dissolution with the liquid, the destruction of the germs of decay by the action of the copper, and a chemical formation, by the iron, which is insoluble in water, with the cellulose or woody fiber. Several experiments have been carried out with wood which has been treated by this process near Vienna. The treated wood was utilized as props in the vineyards and never displayed the slightest tendency to decay. Sleepers treated by this process have also been employed on the Bavarian government railways, and it has been found that even the softest woods are rendered as strong and as durable as oak by the solution.

The History of Babylon.

We may soon, says The Literary Digest, be in a position to study the lost history of Babylon, as we can now study that of Greece and Rome. In a recent lecture at the Industrial Art Museum at Berlin, Prof. Delitzch, the celebrated Orientalist and explorer, stated his hope, says Biblia (June), "that in a short time it will be possible to reconstitute the history of Babylon from its monuments. Contemporary inscriptions on monuments show that the excavators are unearthing the relics of a prehistoric epoch antecedent to the period to which we assign Abraham. The list of kings will furnish an excellent foundation for the historical reconstruction of the epoch."

This has been made possible by the discoveries of the expedition sent out by the German Oriental Society under the direction of Koldewey. Nebuchadnezzar's favorite temple has already been explored, and the excavators are now attacking "the edifice proper, in which Cyrus signed the edict authorizing the return of the Jews to their own land, and in which Alexander died."

IN the Palace of Optics at the Paris Exposition 800 or 900 vacuum tubes are used, producing a remarkable effect.

Correspondence.

Air Resistance to Moving Bodies.

To the Editor of the Scientific American:

The newspaper reports of Mr. Adams' experiments with air-splitting trains, and the ill-considered theories which he has taken the trouble to publish, lead one to wonder why he adopted such an expensive and cumbersome plan of proving the fallacy of these theories, which even the highly colored accounts referred to establish beyond dispute. The speeds claimed were not extraordinary, taking the capacity of the engine and the weight of the train into account, except when descending the grades, and even the maximum speed of 102 miles per hour has been equaled, with a heavier train, on one of the level roads between Philadelphia and Atlantic City.

If air resistance is such a dominant factor in the consumption of the power of the engine, why did not Mr. Adams' train run faster on the grades? Either this resistance does not exist, or else Mr. Adams' housings did not remove it. We are all familiar with the remarkable run, made on one of the Chicago and Buffalo roads, a few months ago, when a very commonplace locomotive, with a heavier train, on about an equal grade, out-raced Mr. Adams' train by several miles per hour. The exact figures cannot at present be given, but the statement is approximately correct. It is also a well-established fact that the drawbar pull or traction effort of the engine does not increase on level roads with the higher speeds, except under accelerative stresses, which, of course, are at all times proportionate to the inertia of the train and the increase in speed. On the contrary, it has been shown by tests, published in The London Engineer, that at certain uniform speeds, above fifty miles per hour, the tractive power demanded is even less than at lower speeds. What becomes of Mr. Adams' theories if this is true? It was clearly shown that the horse power developed was considerably less at these high speeds, back-pressure and "wire-drawn" admission being the chief obstructions to the attainment of higher cylinder power. After a certain speed is reached the horse power of the engine cannot be increased, and frequently cannot be maintained, owing to these difficulties of admission and exhaust, together with a limited boiler capacity; and this is the mysterious resistance that has switched Mr. Adams off on the wrong track.

A heavy head wind is not a serious obstruction to the attainment of high speeds, in spite of the greater atmospheric density induced thereby, but side winds are fruitful causes of late trains, which show beyond question that friction and not air resistance is the arch enemy of high speed. In still weather a large body of air is swept along with the train, but, moving at lower velocities as the distance therefrom increases, shows conclusively, although it is a self-evident truth, that each stratum of air passes over the next, with much less friction, than the innermost stratum would sweep over the walls of a train however smooth or unbroken, and that this stratum, therefore, although a thin one, has practically the same velocity as the train. Anyone who has not learned this by observation, may do so by holding the hand close to the outside wall of a fast train, below one of the windows. It is surpassingly strange that such evidence as this should be ignored by a student who makes a specialty of this interesting subject. W. F. Cleveland.

Penetang, Ontario, Canada.

Ethnology at the Pan-American Exposition.

BY DR. A. L. BENEDICT.

The Exposition has provided a circular building 128 feet in diameter, and has also arranged for a "Six Nation" Indian Exhibit on the grounds, with a representation of the typic "Long House" of the Iroquois and an attendance of some sixty Indians, who will be engaged in such industries as basket-making, woodwork, etc. As these Indians are pagans and have preserved to a great degree their ancient customs, they will celebrate in appropriate seasons their various thanksgiving festivals, dances, and other rites.

Every precaution will be taken to protect exhibits against fire or theft and loss in packing and unpacking. It is expected, therefore, that a large amount of valuable archæological material will be placed at the disposal of this department by museums and individual collectors. In fact, it is not too early to assure the public that the promises of such institutions as the American Museum of Natural History, the Peabody Museum, University of Pennsylvania, University of Chicago, and the Buffalo Society of Natural Sciences, as well as the friendly co-operation of the ministers of the South American republics, guarantee the success of this department. At the same time, there is always room for more, and as the aim of this department is not so much to get together a large miscellaneous collection of relics as to afford a means of popular instruction in American archæology, it is desired that students from all parts of the country shall send on exhibits or memoranda descriptive of results obtained in their special fields of labor. For example, one exhibit will show the animals domesticated by the aborigines of the Western Continent, and will explain why the lack of large, useful animals capable of domestication hampered the development of civilization in the New World.

Through the co-operation of the Department of Agriculture and Horticulture exhibits will be made of the plants cultivated in both North and South America before the discovery.

Often the placard is of as great value as the specimen, and one of the features of the exhibit will be cases describing in brief various types of stone age implements and the method of manufacturing them. Any student of American archæology, who has elaborated some special phase of the subject and wishes to place his work before the public may send on manuscript, and placards will be made from it, with due credit to the investigator. While such placards should be illustrated by actual specimens, it is not necessary that the specimens should occupy a great amount of space, and in many instances we may be able to supply needed illustrations if proper descriptions are sent. One point, however, we would like to have made perfectly clear, namely, that mercenary collectors will not find the Pan-American Exposition a source of revenue, although there would be no objection to a modest advertisement placed in a case of relics which are otherwise of scientific value.

FIRST-CLASS BATTLESHIP "KENTUCKY."

With the departure of the first class battleship "Kentucky" to join the North Atlantic Squadron, the United States Navy is strengthened by the addition of the second of a pair of battleships which, because of certain novelties in construction, have attracted, perhaps, more attention than any other vessels in our navy. The "Kearsarge" and the "Kentucky" were authorized on March 2, 1895, and the contract for the construction of both vessels was secured by the Newport News Shipbuilding Company, these being the first battleships to be undertaken by that now famous yard.

At about the time that they were authorized Lieut. Strauss, of the navy, had proposed that, with a view to securing the greatest possible amount of all-round fire, the 8-inch guns of the intermediate battery should be superposed above the turrets containing the main battery of 13-inch guns. The idea commended itself to Admiral Sampson, who was at that time Chief of the Bureau of Ordnance, and after a considerable amount of discussion it was decided to give the proposed system a trial upon the two new battleships, which at that time were known as Nos. 5 and 6. The design of the Bureau of Ordnance was taken in hand by the Construction Department and the details of the installation of the guns in the double turrets were very skillfully worked out by Naval Constructor Woodward. Advantage was taken of the rapid improvements which had been made in the electrical arts to provide a complete electrical equipment for the operation of both the turrets and the guns. The keels of both vessels were laid on adjoining slips on January 30, 1896, and 21 months later, March 24, 1898, both vessels were launched with imposing ceremonies; this being the first instance, we believe, of a double launching of battleships in the history of our modern navy. The "Kearsarge" was the first of the two vessels to be completed, the delay, both in her case and in the case of the sister ship, being due largely to the incomplete state of the armament. The two vessels are practically identical, and a description of one will, therefore, apply very closely to the other.

The "Kentucky" is 368 feet on the waterline, has a beam of 72 feet 2½ inches, and when the ship is fully equipped, ready for sea, with all stores on board and a normal coal supply of 410 tons, her maximum draught will be 25 feet 1 inch, and her displacement 11,525 tons. This is an unusually moderate draught for a battleship of over 11,000 tons displacement, and it is gratifying to know that these ships and the later vessels of the "Maine," the "Alabama," and the "Georgia" classes are to be restricted to the same draught. The later battleships of foreign navies exceed these vessels in draught by from 1 to 3½ feet; thus, the "Kaiser Friedrich," of the German Navy, draws about 26 feet, the French "Jaureguiberry" 27 feet 9 inches, the Italian "Re Umberto," 28 feet 6 inches, and the British "Majestic," 27 feet 6 inches, while the "Italia," of the Italian Navy, draws 31 feet 6 inches; although it is scarcely fair to include this vessel, which was launched in 1880, in the present comparison. The advantage of a moderate draught can scarcely be overestimated, and in naval operations that are conducted in shoal waters, it may easily prove to be the decisive factor. Were our own shore the object of attack and the exigencies of the campaign demanded that we should act on the defensive, it would be possible for our ships to retire into harbors and channels, into which the attacking ships, because of their greater draught, could not enter; and if we should be carrying on a campaign in foreign waters, it would be possible for our heavily armored battleships to enter bays and harbors and pass through straits which would be closed against the deeper armored ships of the enemy.

The defensive qualities of the "Kentucky" are of a very high order. In the first place, the whole of her armor has been treated by the Harvey process, and although ton for ton, it is inferior to the Krupp armor, its greater thickness will put the "Kentucky" on fairly equal terms, as regards protection, with the latest battleships of foreign construction. The waterline armor extends from abaft the after superposed turrets forward to the bow, and the absence of vertical waterline armor from the after turret to the stern is compensated for by giving the curved protective deck in this locality a thickness of 5 inches. The belt extends from 3 feet above to a depth of 4½ feet below the waterline. Amidships this belt is 16½ inches thick on its upper edge and tapers vertically to a thickness of 9½ inches on its lower edge. It also diminishes in thickness gradually from amidships to either end, the thickness of the bow being about 4 inches. Massive bulkheads also extend across the ship abreast of the barbettes to a junction with the side armor, thus presenting a complete wall of vertical armor around the engine rooms, magazines, and boilers. Above this belt is a flat deck of Harveyized steel which is 2¾ inches in thickness. Forward of the turrets this deck is of a turtle-back form and 3 inches in thickness. It curves down gradually toward the ram bow and is worked into the structure of the ram, serving to greatly stiffen the latter and to assist in transmitting the shock of ramming throughout the whole structure of the vessel. Barbettes of 15-inch steel are built up from the protective deck to a height of 3 or 4 feet above the main deck, and above these are carried the superposed turrets, the turning gear and ammunition hoists of the turrets being protected by the barbette armor. The greatest thickness of the armor on the lower half of the turrets is 17 inches, and on the upper half, containing the 8-inch guns, the armor is 11 inches in thickness. The space amidships between the superposed turrets is occupied by a powerful secondary battery of fourteen 5-inch rapid-fire guns, which are carried seven on each broadside. The whole of this battery is inclosed by a wall of 5½-inch armor, which not only protects the guns from direct attack on the broadside, but also extends obliquely across the ship and prevents the enemy from raking the battery from an end-on position. Mounted on the superstructure deck above the secondary battery are a dozen 6-pounders, eight of which are mounted in broadside, while the other four are mounted so that they can fire on the broadside or dead ahead or dead astern. On the berth deck are eight other 6-pounders, four of which are mounted in the bow and four astern.

The electrical installment of the "Kentucky" is more complete than has been supplied on any previous battleship, except, of course, her sister ship the "Kearsarge." Two 50 horse power motors are installed in each turret for turning the same; 20-horse power motors operate the ammunition hoists to the 13-inch guns and 6 horse power motors perform the same service for the 8-inch rifles. There are also special electrical motors for elevating the guns, working the rammers and blowing the gases out of the bores of the 8-inch and 13-inch guns. In addition to the plant connected with the turrets, electric power is utilized in the operation of 10 endless-chain, ammunition hoists for the 5-inch and 6-pounder guns. There are also six electric deck winches, and the four big boat cranes, which project above the superstructure, are also operated by electric motors. The ventilating of the ship is performed by thirteen electrically-driven ventilating fans.

The view on our first page, showing the "Kentucky" under way, gives an excellent idea of the very shapely appearance of this handsome vessel. Whatever may be said of the advantages or disadvantages of the double-turret system, it cannot be denied that, on the score of appearance, there is a decided gain. The concentration of the heavy guns at either end of the ship and the long line of the 5-inch rapid-fire battery, with the 6-pounders above it amidships, has a look of simplicity and convenience. If one could suggest a feature that would add to her beauty, it would be the raising of the free-board from the bow to the foremast by the height of one deck, as in the case of the ships of the "Alabama" and "Maine" classes.

The official trial trip of the "Kentucky" took place on November 24, 1899, over a measured 33 sea-mile course between Cape Ann and Cape Porpoise. The vessel was run over the course twice and the mean speed for the two runs with tidal connections was 16·9 knots per hour; the horse power developed by the main engines being 11,081·9, and by the auxiliaries in use 236·5. The coal consumption worked out at 2·63 pounds per horse power per hour.

The Library of the Temple at Nippur.

Dr. H. V. Hilprecht, of the University of Pennsylvania expedition into Nippur, has arrived at Constantinople after having discovered the library at the Great Temple, and over 17,000 tablets dealing with literary and historical matters. None of them are of a later date than 2280 B. C. The remains of the library will require five years to excavate. There is every indication that the discoveries will give us a complete record of the ancient civilization.

Science Notes.

According to The Sanitary Record, meats frozen and kept in cold storage for long periods do not undergo organic changes in the ordinary sense, but they certainly do deteriorate in some intangible way. After a certain time frozen meat loses some life-principle essential to its nourishing quality.

The British Association celebrate their seventieth annual meeting at Bradford commencing September 3. The president this year is Sir William Turner, who is probably the most distinguished anatomist of the day, and he will doubtless deliver an address bearing upon a branch of this science. Other lectures will include one upon "Animal Electricity," by Prof. F. Gotch; "Range Finders," by Prof. W. Stroud; and one for the benefit of artisans, by Prof. Silvanus Thompson. The proceedings will be enlivened by the various entertainments which always characterize this annual gathering of scientists.

During the celebration of divine service at St. Botolph's Church, Boston (England), while a storm was raging, the lofty tower was struck by lightning, and a large pinnacle was torn from its place, crashed through the roof of the building, and alighted on the floor 300 feet below, where it was shivered to pieces. The congregation rose to their feet and rushed to the doors in terror. The clergy remained at their posts and by dint of much persuasion at last restored order so that a panic was averted. Fortunately, no one was injured, either in the rush for the doors, or by the flying fragments of the broken pinnacle.

The American walnut, which has long been such a favorite wood in England, has met a powerful rival which threatens to supersede it in the English markets. This is the Cape laurel wood, a report upon which has recently been prepared under the authority of the Imperial Institute of London. This new wood is very hard to saw, but planes easily and turns well, while the polish that may be imparted to its surface is extremely brilliant. It is of a fine rose color, and possesses a pretty figure. There is one very prominent peculiarity in this wood that causes the workmen to sneeze violently and continuously while operating it, even with the saw.

Edward Hale, the well-known English cyclist, has recently completed a unique cycling performance, viz., the riding of 100 miles per day for a year, Sundays excepted, upon an Acatene chainless cycle. The distance he has covered is 32,479 miles upon the high roads in all parts of the country. Hale was as sound in health after he had completed his performance as he was when he first set out, the only difference being a decrease of seven pounds in his weight and a slight enlargement of the heart, which is generally the resultant effect of a course of violent gymnastics. The cycle has stood the trial well. The bevel gear has given no trouble whatever, and has stood thoroughly, the repairs to the cycle only comprising renewals of the bearings and the tires.

A school of tropical diseases, similar to those already in existence in London and Liverpool, is about to be opened at Hamburg, in Germany. Dr. Nocht, the port medical officer of Hamburg, has been visiting the English schools for the purpose of studying the work in each establishment, since the Hamburg school will work in co-operation with the two English schools. Dr. Nocht has had an interview with Mr. Chamberlain, the English Colonial Secretary, who is intensely interested in the subject. In fact, it was mainly due to the indefatigable efforts of the Colonial Secretary, in conjunction with some West African traders in Liverpool, that the schools were founded in England. It is contended that once the malaria is suppressed in West Africa the country will become a second India.

Prof. W. Ramsay and Dr. Travers have been exhibiting to the Fellows of the Royal Society in London a beautiful collection of vacuum tubes charged respectively with samples of the various new gases which they have succeeded in obtaining from our atmosphere. The gases, five in number, are as follows:

Helium	with an atomic weight of			4.
Neon	"	"	"	20.
Argon	"	"	"	40.
Krypton	"	"	"	80.
Xenon	"	"	"	128.

When the electric spark is passed through the tubes some very beautiful color effects, remarkably rich and pure, are obtained. Especially noticeable in effect is that obtained in passing the spark through neon, when a magnificent crimson glow is yielded. The scientists also exhibited the apparatus by which they succeeded in separating these gases from the atmosphere and from one another. The process consists of fractional distillation. A vacuum vessel is filled with liquid air, and into this is dipped a narrower tube which is sealed at the bottom, but is connected at its upper end with a mercury aspirator. Impure argon is then liquefied in this narrow tube, after which, by operating the aspirator, the more volatile impurities distil over first, and can be collected for further examination or purification. Xenon is the heaviest simple gas which has yet been discovered, its density being 64, or about 4½ times that of the air we breathe.

Electrical Notes.

The introduction of the trolley in the French Riviera has resulted in injury to the telephone lines, which are of the grounded pattern.

It is proposed to erect an electric light plant at Simla, the summer capital of India. It is in the foothills of the Himalayas, and water power is abundant. Kerosene is used at the present time.

To measure comparative sound intensities, M. F. Larroque uses an electro-magnetic transmitter and receiver, the latter containing a core of iron filings. The sound is reduced to silence by suitably withdrawing a portion of the core, and the silencing points of two sounds are compared.

A novel type of trolley is used on the Dublin United Tramways. It is of the swivelling arm type, placed at the side of the car so as to be out of the way of the passengers, who ride on the top of the cars. The trolley-wheel is small and is contained in a casting. There is a kind of double swivel joint which assists in keeping the trolley on the wire.

A group of apartment houses in Utica, N. Y., is provided throughout with electrical cooking utensils, consisting of three round platters, or 'stoves," an oven, and a broiler. When not needed they can be stowed away, leaving no outward trace of the use to which the room is put. The air is not vitiated, and the apartment is kept much cooler. The same apartments are provided with electric curling-tongs heaters, which are much appreciated.

During a violent thunder storm in the north of England a flash of lightning struck a pasture field, and plowed a trench, varying from 3 feet to 3 feet 6 inches deep, and about 7 inches wide, across the field for a distance of about 12 feet. The solid clay was scattered in all directions, one clod being hurled as much as 60 feet away from the spot. The turf was torn up as cleanly as if it had been removed by the aid of a sharp implement. One length of turf, measuring about 6 feet in length and 9 inches in width, was cut up and thrown over a fence into another field.

Experiments are being conducted in Budapest with high-pressure rotary current for working an electric railway on a system introduced by Ganz and Company, says The Engineer. It is stated that, despite the high working pressure of 3,000 volts which is used, the system ensures complete safety even in its application to main line working. Experimentally, the system is to be introduced on the Valtelina stretch of the Italian State Railway, which has a length of almost sixty-six miles. The length of the cars which are worked by the new system amounts to 60 feet, while the speed attained is about thirty-seven miles per hour.

Inquiry was recently made by the German Government, says The Chicago Tribune, into the effect of lightning upon trees. Observations were made by overseers of foresting stations scattered over an area of 50,000 acres in the district of Lippe. The forests comprised 70 per cent of beech trees, 13 per cent of pines, 11 per cent of oaks, and 6 per cent of firs. Of 275 trees struck by lightning, 58 per cent were oak, 21 per cent fir, 8 per cent beech, and 7 per cent pine. These figures show the extreme susceptibility of the oak to lightning stroke, and the large and disproportionate percentage of its attack upon the fir. The beech appears to be almost immune from lightning stroke. While 70 per cent of the forest trees were beeches, they received only 8 per cent of the strokes, or about one-ninth of their proportionate share. It has often been asserted in England that the beech was never struck by lightning. While the German observations disprove this broad assertion, they amply justify the common belief in the rarity of the occurrence.

Mr. L. B. Miller, of London, has patented an invention for the purpose of decohering rapidly in connection with wireless telegraphy. To attain this end, the inventor attaches the coherer to the light armature of a small and very quick-acting electro-magnet. The latter is thrown into action by the relay, the sudden jerk forward of the armature serving to decohere the filings. The speed of decohering may be greatly increased if the movement of the armature away from a stop is made to break the coherer circuit. When this is done, it is possible to more delicately adjust the relay, and then when the shunt circuit through the relay is opened the received wave can only pass through the coherer. The inventor states that the coherer filings should be of a metal or alloy, that cannot be magnetized owing to the proximity of the electro-magnet. The coherer is constructed so that it can be exhausted and sealed with little possibility of its sensitiveness being impaired by the hot blast of the glass blower, by fusing into the bottom of a glass tube the two platinum wires attached to the lower metal electrodes, insulated from one another, and afterward cleaning the acting surface from the open end of the tube, inserting filings and a plug or screw, and finally exhausting and sealing up the open end. To obviate self-induction a Morse local inker can be attached in parallel to the decohering magnet, or an electro-chemical recorder may be employed for this purpose.

Engineering Notes.

The "Pom-Pom" gun, which has played such a prominent part in the South African war on the sides of both belligerents, has not proved a very great success with the British forces. Owing to the rough nature of the country over which the guns were dragged, and the pace at which the army traveled, the guns were thrown out of gear. Several experiments were tried to overcome this difficulty, but without success. This is said to be the reason why the Boers carried their guns about in the ambulance wagons, since, as these latter were fitted with springs, the guns were not thrown out of adjustment.

The Paris Underground Railway was opened on July 21st, and it carried thirty thousand persons between Porte Maillot and Vincennes. There was a considerable difference in temperature noticeable on leaving the street, the tunnel being rather chilly. Paris has heretofore been the most backward city in the world, as regards transportation facilities, and the new line is only an earnest of the vast improvements. The journey on the recently completed line requires only half an hour, while by the ordinary tramway one hour is consumed. The fares are five cents for first-class passengers and three cents for second-class passengers, and the trains are run on ten minutes' headway. When the entire underground system is completed there will be thirty-nine miles of railway, and the cost will be $40,000,000.

The new Elbe and Trave Canal has been completed at a cost of $5,831,000. It was formally opened by the German Emperor on July 16. The length of the new canal, which is the second to join the North Sea and the Baltic, following the Kaiser Wilhelm Ship Canal, or Kiel Canal, which was finished five years ago, is about 41 miles. The available breadth of the new canal is 72 feet. The breadth of the lock gates is 46 feet, the length of the locks 87 yards, and the depth of the locks 8 feet and 2 inches. The canal is crossed by twenty-nine bridges, which were built at a cost of $1,000,000. The span of the bridges is in all cases not less than 30 yards and their height above water level 15 feet. There are seven locks, five being between Lubeck and the Möllner See—the highest point of the canal—and between Möllner See and Lauenburg-on-the-Elbe.

The English War Office is experimenting with a new magazine rifle. It is the invention of an Australian, and it possesses several advantages over the Lee-Metford arm, which is at present employed in the British army. The automatic feed of the cartridges from the magazine into the breech is a striking feature. It was tried at Bisley in the recent competitions and fired thirty shots in the minute, with twenty-eight hits, of which seventeen were bull's-eyes. The rifle is said to be vastly superior to either the Lee-Metford or the Mauser in strength, efficiency, and simplicity of construction, while it is 35 per cent cheaper to manufacture, and is 1¼ pounds lighter than the present Lee-Metford rifle. It has been strongly recommended by Lord Charles Beresford, and there is little doubt that it will be introduced into the British army at the end of the South African campaign.

The new Central London Electric Railway, which was opened to public traffic a few weeks ago, has proved a prodigious success. During the first four days it was opened no less than 353,000 people availed themselves of this new means of rapid transit, to the detriment of the omnibuses. So startling has been the enthusiastic reception of the innovation, that the Underground Railway, after many years' controversy and spasmodic experiments, have finally determined to convert the whole of their system to electric traction with all possible dispatch. This resolution has probably been accelerated by the significant fact that in the new Electric Railway they have a powerful rival, which is both quicker, cheaper, and cleaner than their own antiquated method of locomotion. At the recent meeting of the Underground Railway Company, the chairman announced that without any further delay electric traction should be installed upon the outlying portions of their system, since their own experiments between Earl's Court and Kensington with an electrically propelled train had convinced them that an electric locomotive could haul a greater weight than the ordinary steam locomotive, that it was more economical, and that the atmosphere of the tunnels was maintained in a much purer condition. Of course, the great difficulty that presents itself in connection with the electric conversion of the Underground Railway is the question of the intercommunication of the other great trunk railways of the country. The leading railways have not one central depot in London in which all the railways converge, but rely for communication between the various termini upon the Underground Railway system, and as they have full running powers over portions of the latter's system, it is not probable that they will introduce electric locomotives especially for this intercommunicative traffic. Therefore, it will probably be impossible to banish the steam locomotive entirely from the Underground Railway.

SALVAGE OF THE "OREGON."

The accompanying photographs of the salvage of the "Oregon" have been received from Mr. W. Grigg, third engineer of the steamship "Nanchang," which was chartered at Chefoo, North China, to proceed to the assistance of the "Oregon" immediately after it had grounded in the Gulf of Pechili. The submerged rock on which the vessel was impaled lies to the northward of Miau Tau Islands and projects pinnacle-like from very deep water. Rocks of this kind are not uncommon, and form one of the greatest perils of navigation in some of the Eastern seas. One of our photographs was taken from the "Nanchang," when this vessel was towing in the effort to pull the "Oregon" from the rocks, and the smaller picture shows the 10-inch pumps which were used to keep down the water in the hold of the "Oregon."

The description of the operations is best given in the writer's own words:

"The "Nanchang" was chartered at Chefoo, North China, to proceed to the "Oregon" and assist in floating her. We left Chefoo on the morning of June 30, arriving at 10 A. M. on July 1, and made fast alongside. The battleship we found was badly ashore on a pinnacle rock, and heeling over at an angle of 10°, with ten to seventeen fathoms depth of water all round the ship, and three or four of the forward compartments full of water. We commenced to take out ammunition, davits, cables and anchor, etc. The "Oregon" had two 10-inch pumps working, which were secured from the "Tokio Marie," a Japanese steamer that ran ashore some time ago, about 10 miles away, off the same island. The pumps were doing good work and keeping the water under.

"At 11:40 A.M., July 1, we passed a hawser aboard the "Oregon" and commenced to tow her, the tide serving at that time. At noon the battleship cleared the rock. At 12:10 P. M. we let go our hawser, the "Oregon" using her own engines; but shortly afterward she struck on another rock. At 2 o'clock we resumed towing, assisted by the steamship "Kwongsang," towing till 5 o'clock, but unable to shift her. The following day at 1:10 P. M. the "Nanchang" and the steamship "Kwongsang" were made fast to the "Oregon," one on each side, and towing was resumed, the British cruiser "Endymion" having come up and passed a hawser aboard the "Oregon" astern. The "Endymion" carried away her own hawser, and shortly afterward another one belonging to this ship. She again sent aboard her own hawser, and the three ships made another attempt, the "Oregon" using her engines as required; but were unable to shift her up till 3:45 P. M., the tide having fallen too much to render any further attempt that day successful. Coal and ammunition and heavy weights were being discharged the whole time to lighten the ship. Another attempt was made on the 4th, but proved unsuccessful. On Thursday, July 5, we were preparing to make another attempt to tow her off, when, at 1:35 P. M., the "Oregon" floated off unaided. We towed her a short distance and anchored in 19½ fathoms water at 2 P. M. The following day we towed the "Oregon" round the island to Hope Sound, clear of the strong tide, to enable the divers to plank over the holes in ship's bottom, a task which will occupy four or five days. She will then proceed to the Japanese Naval Dockyard at Kurê, to be temporally repaired, to enable her to return to San Francisco."

The "Oregon," favored by calm weather, made the trip to the dockyard without further mishap, and is now undergoing sufficient temporary repairs to enable her to take part in the Chinese campaign.

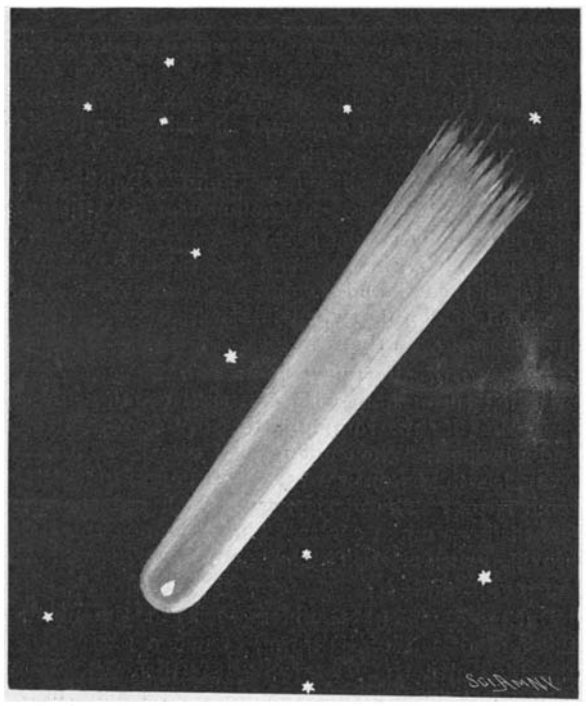
Motor Boats on the Dead Sea.

The Dead Sea, having for thousands of years been a solitude in the midst of a desert, is to have a line of mechanically propelled boats. The first steamer is 100 feet long and left Hamburg for Palestine on June 16, and a second steamer has been ordered. The first vessel has been named "Prodromus," the "forerunner." It will carry freight and thirty-four persons. The promoters of the enterprise are the inmates of a Greek cloister in Jerusalem, and the management is in German hands. The influx of tourists in the last few years has been notable.

THE BROOKS COMET.

The new comet discovered by the writer on the morning of July 23, while sweeping the eastern heavens with the equatorial refractor of this observatory, has been regularly observed on every clear night.

It continues a bright and very beautiful telescopic object, resembling very much a great naked eye comet



COMET DISCOVERED BY DR. BROOKS, JULY 23, 1900.

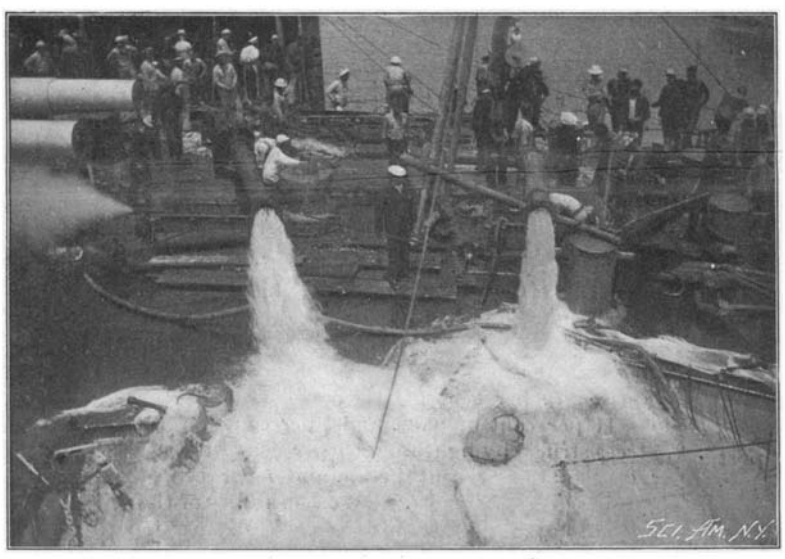
in miniature, its appearance, as seen in the 10-inch refracting telescope, being well shown in the accompanying cut. The nucleus is remarkably stellar, and sharply defined. For several days after discovery the nucleus was elongated in the direction of the tail. It is now more nearly round and slightly diffused. The motion of the comet has been rapid and in a northerly course. Its position at discovery, on July 23, as already announced in these pages, was R. A. 2 h. 43 m. 40 s.; declination north 12° 30 m., and the comet was only observable in the eastern morning sky. By August 1 the comet had moved to north declination 39° 31 m., and was in the same wide power telescopic field with Algol—the demon star. At my latest observation, last evening, the comet's position was R. A. 2 h. 55 m. 35 s.; declination north 59° 7m. This observation was made in the presence of a nearly full moon, which shows the brightness of the comet. On August 22 the comet will be in R. A. 5 h. 46 m.; declination north, 84° 10 m. or within 6° of the north celestial pole, and below the pole.

It is now in the circumpolar constellation camel-pardalis, is moving upward through that figure, and by the last of the month will be in the head of this constellation. By plotting these places upon a star atlas the comet's course through the northern heavens may be followed for several weeks.

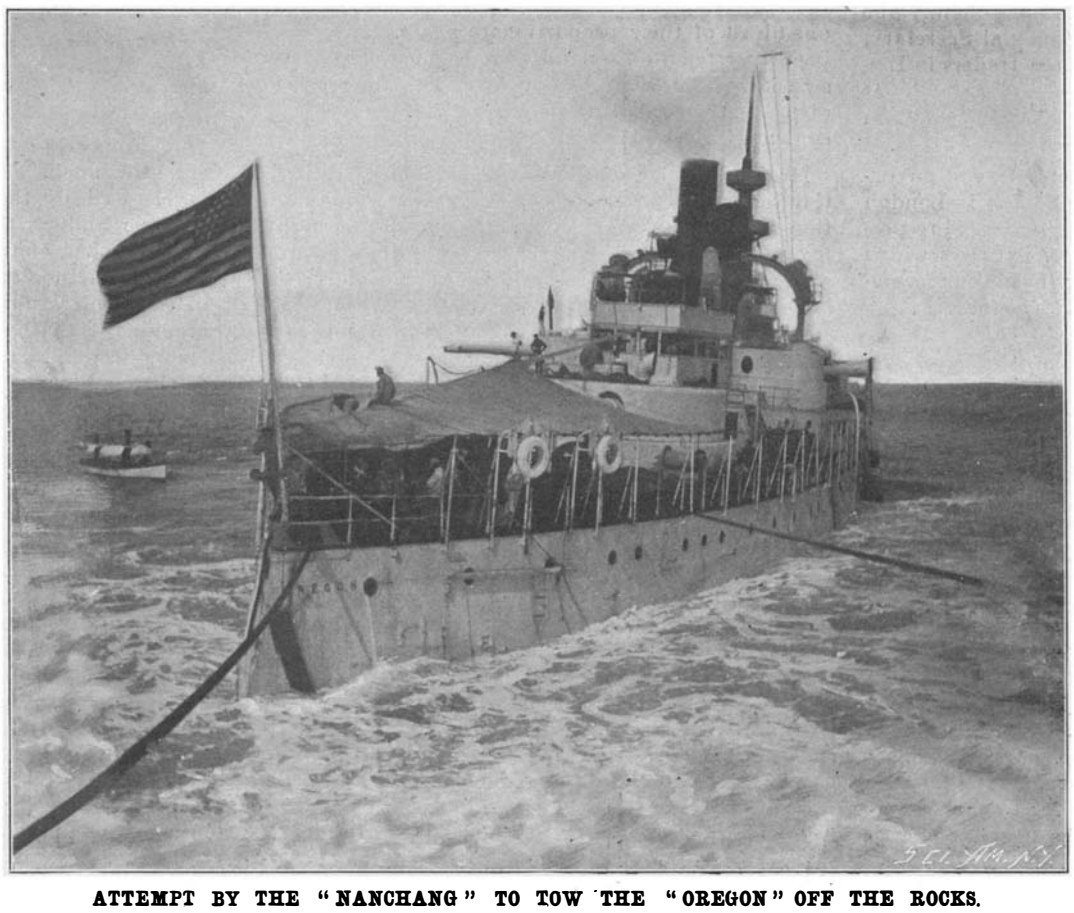
The comet passed perihelion on August 3, and is, therefore, becoming fainter, but it may be observed with telescopes of moderate apertures,

WILLIAM R. BROOKS.

Smith Observatory, Geneva, N. Y., August 9, 1900.



FORWARD DECK OF THE "OREGON," SHOWING TWO 10-INCH STREAMS DISCHARGED FROM THE FLOODED COMPARTMENTS.



ATTEMPT BY THE "NANCHANG" TO TOW THE "OREGON" OFF THE ROCKS.

The Jesup North Pacific Expedition.

Messrs. Jochelson and Bogoras, of the Jesup North Pacific Expedition, have started for the northeastern part of Asia to continue the work of the expedition in Siberia. The region which they are about to visit is situated northeast of the Amoor River. They will study the relations of the native tribes of that area to the inhabitants of the extreme northwestern part of America, and also to the Asiatic races visited previously by Dr. Laufer, and to those living farther west. It is believed that the result of their explorations will result in clearing up the racial history of these people, and it is hoped that the question as to the relations between the aborigines of America and Asia will be definitely settled. The work of these explorers is part of the general plan of the Jesup North Pacific Expedition, which was organized for the investigation of the relations between the tribes of Asia and America.

The gold discoveries along the coast of Behring Sea are, of course, rapidly changing the conditions of native life, so that in a few years their primitive customs, and possibly the tribes themselves, will be extinct. The expedition, after leaving Vladivostok, will go by sea to the northwestern part of the Sea of Okhotsk. Mr. Jochelson expects to spend the winter among the tribes of this coast. Mr. Bogoras will make a long journey by dog-sledge across that part of the country which is north of the peninsula of Kamchatka. After completing his work, Mr. Jochelson will proceed in a northwestward direction, crossing the high mountains which stretch along the coast, on a trail never before visited by white men. He expects by this route to reach the territory of another isolated tribe, the Yukagheer. He will not return to the coast of Okhotsk, but will continue his journey westward through Asia. Both gentlemen have carried on remarkable investigations in Siberia. Their journey will occupy two years and is certain to be productive of important results.

A Kite and Balloon Station Near Berlin, Germany.

The Berlin correspondent of The Standard announces that the Royal Prussian Meteorological Institute in Berlin is about to make arrangements for the systematic examination of the higher strata of the atmosphere by means of special apparatus, says Nature. In the grounds of the Aeronautical Observatory, at Tegel, a suburb of Berlin, where Alexander and William von Humboldt were buried, registrations of the atmospheric conditions at a height of three to five thousand meters will be carried on, if possible, day and night with kites and kite-balloons. The registering apparatus, which automatically records the pressure, temperature, humidity, and wind velocity at these heights, is taken up by a kite-balloon connected with the earth by piano wire. An elevation of 1,500 meters has been attained by a train of kites even without balloons when there was sufficient wind.

PARIS EXPOSITION.—INTERIOR OF THE PETIT PALAIS.

The interior of the Petit Palais is reached through a high arched doorway; the main doors are of glass, framed in gilded iron work of artistic designs. The front part of the building, which corresponds to the main façade, consists of a central rotunda, from which a flight of steps leads up to a long gallery on either side. The rotunda, opposite the main entrance, represents the portion under the central dome; the lower part is lined with a variegated marble; in the corners are four niches containing fine groups of statuary; the marble finish ends in a cornice, above which the interior of the dome is finished in stucco with handsome relief ornaments. The floor is formed of a mosaic pattern. In the center is represented a horse, upon which is mounted the suit of armor worn by François I. The two galleries have eight windows in front, and a semicircular ceiling of stucco in relief. Between the windows are mounted suits of armor of different periods, and in the center is a horseman in armor; the walls are hung with rich tapestries. The rear door of the rotunda leads into the central court, seen in the illustrations, which is of semicircular form. The colonnade surrounding the court is formed of polished granite columns arranged in pairs, upholding a superstructure of light stone, carved and inlaid with porphyry panels. It is relieved by ornaments in gilded metal, and metal garlands are hung between the columns. The pavement is laid in mosaic and the walls are formed of porphyry and marble in various designs. The central doorway, shown on the left of one of the illustrations, is upheld by two granite columns on each side; over the arch are finely executed figures in high relief; at the top are two figures in gilded bronze. The court is tastefully laid out; the three basins are surrounded by mosaic borders in blue and gold, and the flower beds and plants add greatly to the effect. In the center is a copy of a celebrated group by Chardin.

The galleries contain a retrospective collection, representing the national art in its different forms from the earliest times down to 1800. No pains have been spared to bring together a collection worthy of the occasion; here are to be seen Gobelin tapestries, carved wood, porcelains, ivory, enamels, etc.; the objects have been loaned by the government, by museums and cathedrals, and by private persons. The galleries are divided into two series, inner and outer. The walls of the inner series are lined with Gobelin and other tapestries. The collection of Celtiberian and Gallo-Roman objects are of especial interest, and show bronze swords and other arms, fibulæ and head pins, as well as jewelry in gold and rudely cut stones. A number of cases contain earrings in gold and bronze, and various bronze ornaments and objects taken from sepulchers of the Celtic period. Of the Gallo-Roman period, an interesting collection is that of glass vessels of iridescent hues, many of large size, dating from the second to the ninth century. A collection of pottery of the same period has been brought together from the different parts of France. Among the objects of the Merovingian period are two swords with rich scabbards in gold relief, besides a number of gold jewels and bronzes. The collection of Limoges enamels, from the eleventh to the sixteenth century, contains remarkable specimens; most of these are in blue and gold designs. Of the porcelains, those of Sevres and St. Cloud are represented in great variety; the Bernard Palissy collection is especially interesting; different pieces have been loaned by the government, by different museums and private collections; Baron de Rothschild has loaned a number of these. The different rooms contain collections of carved ivory, illuminated missals, ornamented metal work and bronzes, etc. Among the metal work is a collection of ancient locks and keys, most of which are artistically worked in relief and open-work designs; these date from the fifteenth to the eighteenth centuries. The outer series of galleries contain a large number of collections; most of the objects are of the Louis XIV. or later periods. They include Gobelin tapestries, carved and inlaid furniture, ornamental clocks, paintings, etc. One of the rooms is devoted to a collection of objects belonging to the various members of the royal family, including the jewel cabinet of Marie Antoinette, of mahogany incrusted with gilded metal and inlaid with mother-of-pearl. A central case contains books and other objects belonging to celebrated persons of the time. A view in one of the outer galleries is shown in the illustration; the handsomely carved and decorated bedstead belonging to the Duke Antoine, 1508–1544; it is loaned by the Museum of Nancy. Opposite it are two carved walnut buffets of the sixteenth century; the tapestries are of the same period.

ROOM IN THE SMALL PALACE OF FINE ARTS, PARIS EXPOSITION.

THE COURTYARD OF THE SMALL PALACE OF FINE ARTS, PARIS EXPOSITION.

New System of Electric Heating.

A new system of electric heat is upon the market. It consists of an electric heater and a blower. The motor is of the standard fan type and is secured to a conical metal case. There is an intake for air at the back. The heater consists of clay tubes wound with fine German silver wire and covered with an insulating coat of enamel. The tubes are arranged radially and the fan and the heater are both closed in by a metallic casing. The heater can draw air from without the room or car, or in cold weather can operate using the air in the room or car. Two of these heaters will, it is said, heat a 40-foot car to the proper temperature. In the ordinary system some of the persons in the cars are uncomfortably warm, while others are cold, but with the fan distribution the heat is positively distributed. The fan will also prove useful in school buildings, on ships and war vessels. It will be specially valuable when vessels are out of commission where it is desired to both warm and move the air.

THE railroads have taken very little interest in acetylene gas for car lighting, and there have been many failures in this field. The Chicago, Milwaukee and St. Paul Railway Company are making experiments in the laboratory on a generator for lighting a car. One advantage of acetylene gas is that each car can be made a separate unit. There are to be service trials of the apparatus on the cars.

NERNST LAMP AT THE EXPOSITION.

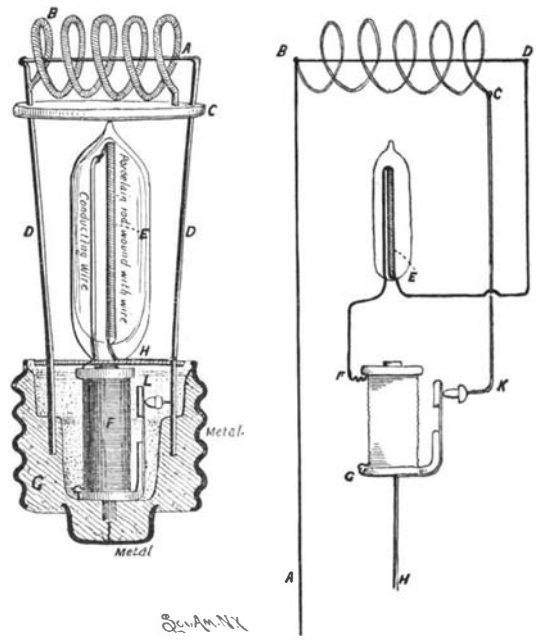
One of the most interesting displays in the Electrical Palace is that of the Nernst lamp shown in the pavilion erected by the Allgemeine Elektricitätsgesellschaft. Two different types of the Nernst lamp are made at present; in the first it is necessary to heat the conducting filament by a match, an alcohol lamp, or the like. The general appearance of this type of lamp will be seen in our engraving. From the base project two metal rods, which are braced at the ends by a short tube of porcelain, and to the ends of the rods is soldered a rather thick platinum wire; to this wire the ends of the conducting filament are soldered by a process analogous to that employed for the incandescent lamp. This filament, made up of refractory oxides, is perfectly white and homogeneous, resembling otherwise a short carbon filament. As the resistance of the filament diminishes when in a state of incandescence, it becomes necessary to insert a resistance in the circuit to cut down the current to the right amount.

The form of resistance used here is shown below the porcelain rod; a very fine platinum wire is wound around a porcelain rod about one inch long, and this is contained in a small glass bulb; the outer end of the wire is connected with a stout wire which passes back parellel to the rod. The terminals are formed of two wires fused into the glass. A lamp base of the ordinary Edison, or screw type, is used, to which is fitted a globe somewhat resembling an ordinary incandescent lamp globe; this, however, is open at the end and serves only to protect the filament from dust, etc. When the flame of a match is applied to the filament, it soon commences to glow, and finally reaches a brilliant incandescence, giving off a white light which is very pleasing in color. The light is much whiter than that given by a carbon filament, owing to the higher temperature of the refractory oxides, and is entirely free from the disagreeable green hue of the Welsbach burner.

It is, of course, quite desirable to have a lamp which is entirely automatic in its action, particularly when it is placed in inaccessible positions, and accordingly an automatic form has been devised, in which the filament is heated by the passage of current through an exterior conductor, and when its resistance has been thus reduced and it allows the passage of a sufficient current to bring it to incandescence, the circuit of the heating conductor is interrupted by a special device. The general disposition of the working parts is seen in the sectional view. From the socket rise two stout wires, *D D*, which support a porcelain disk, *C*. Upon the disk is supported the filament, *A*, and surrounding it is a spiral tube of porcelain, *B*. The porcelain tube carries on its surface a great number of turns of fine platinum wire, which has been wound on while the tube is still straight and before baking the porcelain; the wire is almost completely imbedded in the porcelain and is visible only upon close examination.

This exterior tube serves to heat the filament by the passage of current in the fine platinum wire; a thick wire, not shown in the diagram, passes below from the right-hand end. A small glass bulb placed below contains the resistance wire, wound around a porcelain rod, *E*. This resistance is of the same type as for the first lamp, only one form being used throughout. The lamp base, *G*, resembles the ordinary screw type, but the interior body, of porcelain, is recessed to receive the automatic cut-out device; it also supports the wires, *D D*. The cut-out consists of a small electro-magnet, *F*, fitting in the cavity of the socket; the upper end of the bobbin is of soft iron, and below an iron piece curves up and supports a small armature, *L*, by means of a flat spring. The armature rests normally against a contact piece to the right, but when a sufficient current passes in the coil, the armature is attracted and leaves the contact point, thus cutting off the current from the heating spiral. The action will be clearly seen by referring to the diagram of the electrical connections. The current takes two paths; first, through the filament, the resistance bulb and the magnet, following the circuit, *A*, *B*, *D*, *E*, *F*, *G*, *H*; or, second, through the heating spiral, the contact, *K*, the armature of the magnet, and return, or *A*, *B*, *C*, *K*, *H*. Owing to the high resistance of the filament when cold, the current passing in the circuit of the magnet is not sufficient at first to attract the armature, but a few seconds after it is turned on the spiral commences to heat up, and the temperature of the filament is raised sufficiently to allow a large current to pass; it thus becomes incandescent, and, its resistance being lowered, a large current passes in the magnet; the armature is attracted and the circuit of the heating spiral broken at *K*. When the lamp is turned off, the reverse action takes place; contact is made at *K*, restoring the original conditions.

The price of a lamp with the automatic illuminating device is, of course, much higher than for the ordinary type, on account of the two extra pieces, the magnet and the heating spiral. The magnet, of course, does not deteriorate; the spiral, being subject

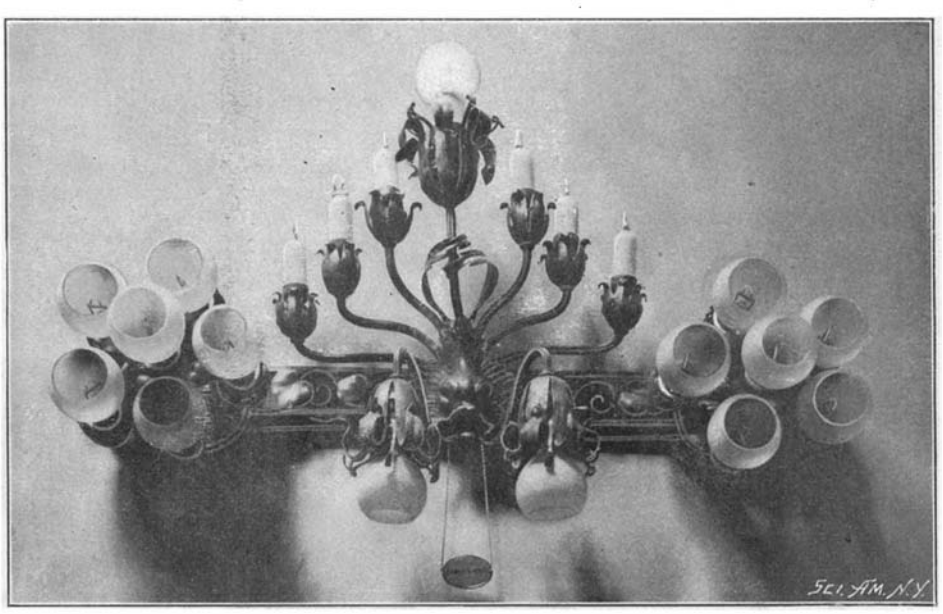


AUTOMATIC TYPE—SECTIONAL VIEW AND DIAGRAM OF WIRING.

to alternate expansions and contractions, lasts a reasonable length of time, but not indefinitely. It is, however, easily replaced, and is taken back for two-thirds of its original value. It is probable, besides, that the platinum wire will be replaced by a material which will give the same service at a less cost. The parts of the lamp which need to be replaced, the spiral

NERNST LAMP—ORIGINAL TYPE.

and the filament, cost but little, and it is estimated that the cost of lamp renewals is not greater than in the case of the ordinary incandescent lamp. The duration of the filament depends somewhat upon the manner in which it is brought to incandescence, whether heated quickly and thus subjected to a violent rush of current, etc. In general, it is less than that of a carbon



CHANDELIER OF NERNST LAMPS.

filament; if the changes in voltage do not greatly exceed the normal, one may count upon an average life of 300 hours for this lamp. The life is diminished gradually by a molecular change, which is produced little by little under the action of heat, accompanied by a diminution of solidity and often an increase of resistance which diminishes its brightness. The expenditure of energy in the present type of Nernst lamp is from 1½ to 1¾ watts per candle power, which is about one-half that of an incandescent lamp; for a 16-candle power lamp the energy consumed is thus from 24 to 28 watts, representing 27 to 30 lamps per horse power. At present the Nernst lamp is manufactured for 25, 50, and 100 candle power, under a tension of 110 or 220 volts.

South America's Dying Races.

THE FUEGIANO AND THE BAKAÏRI PEOPLE.

BY JOHANNES HROLF WISBY.

Before the end of the next century two of South America's most ancient peoples, the Bakaïri and the Fuegianos, will be practically extinct. Both tribes together amount only to a few thousand individuals, and have been rapidly decreasing in number for the last twenty years. The Bakaïri, a branch of the famous Caraïbian race, live in the heart of Brazil. The Fuegianos inhabit the island groups in which the South American continent terminates, and form a distinct tribe of their own.

In olden times, when Spanish ships beat around Cape Horn, these islanders were first discovered by their habit of lighting fires on the shores; for which reason the Spaniards called them Fuegianos or "fire people," and their island home, Tierra del Fuego or the "Land of Fire." Behind the thundering surf they live, almost naked, in a climate as rigorous as that of northern Norway, surrounded by the great oceans of the Pacific and the Atlantic, and with great snow-capped mountains behind them. The climate is a succession of chilling rainfalls and violent storms; a quiet, sunshiny summer day is almost unknown. One would suppose that conditions like these would tend to draw the members of the tribe closer together. On the contrary, everyone lives for himself, and the tribe unites only to fight its enemies. The people have no religion. They believe merely in devils; they do not worship; and they have no idols of any kind. If they hear a noise they cannot account for, they fancy it is some devil on the warpath, and take to their heels. They offer no prayers in such cases, but simply turn about and run, acting apparently on the principle that they can outfoot any devil. Easily frightened as they are in this way, they exhibit no fear when the object making the noise is visible to them. Darwin, who was the first scientist to visit the tribe, as early as 1840, maintained they were cannibals, but his theory has been contradicted by later scientists, a few of whom have succeeded in finding out the real habits of the people by living with them. That they have cannibalistic tendencies is, however, admitted by several travelers; for they make a practice of eating the old women of the tribe when they are no longer of any use. As the family ties are not very strong, and as the children seem entirely to forget the parents as they grow older, it is not unlikely that many a poor old Fuegiano mother has been partly eaten up by her own offspring.

That which more than anything else has made the Fuegianos hardy and able to withstand the trying climate, as well as the fierce onslaughts of the warlike Onas, is their ancient habit of killing the weaker children, permitting only the robust to live. Children thus killed are buried in the ordinary manner of the tribe, entirely without ceremony. If not merely thrown on the charnel heap they are burned in the camp-fire and their ashes strewn to the winds. It is characteristic of the Fuegianos that they endeavor to forget their dead, whose possessions are conscientiously burned, and whose names must not be uttered.

The only animals met with in the country are a species of fox and a species of mouse, but the river-like channels which separate the islands swarm with seals and fish. Occasionally a whale is captured, the oily blubber of which is considered a delicacy, and the bones an excellent material for arrow and spear-heads. Their manner of fishing is peculiar. At dark they set out in their frail, flat-bottomed, bark canoes armed with long fishing spears. Clay is placed in the bottom of the boat, on which they light a fire. Attracted by the fire the fish gather around the boat and are then speared with unerring skill. How the Fuegianos succeed in keeping these badly-leaking and extremely frail shells afloat on the turbulent waters of the ocean around Cape Horn is a puzzle to sailors. They even venture far out to sea, paddling against the current to reach certain shoals frequented by the seal; but often it happens that a fisherman, after battling the tide and the wind, is upset and drowned in the tremendous surf which is at all times thundering on the shores of the island.

From the raw, forbidding climate of the ugly-tempered Fuegianos, we shall repair to the luxuriant tropical regions of the Bakaïri tribe, living in the heart of

Brazil, some forty degrees of latitude north of Tierra del Fuego. By the River Xingo, which pours its waters into the Amazon, the Bakaïri hunters live, the southmost outpost of the Caraïbian race. Plague and disease, doubtless spread by the numerous poisonous insects inhabiting the forest regions, have thinned out their race, and the days of the Bakaïri are numbered. Like the Fuegianos, their life is that of the Stone Age, but as a race they are somewhat superior, although they are also cannibalistic. But it is not the necessity of disposing of a surplus of old women which has whetted the appetite for human flesh. Although the real cause of their cannibalism is not definitely settled, it is extremely probable that through their habit of eating roasted monkeys, which resemble the burned corpses of the native children, they have acquired a taste for human flesh.

Unlike the Fuegianos, they have a kind of "religion." They are great story tellers and dancers, and their sociability and good-nature generally win the confidence of the traveler. Their chief weapons are the bow and arrow, a kind of boomerang, and, above all, the blowgun, from which they shoot the poisonous arrows which are the dread of their enemies. The bow often measures six feet in length, and the feathers which guide the arrow on its flight are set spirally, so as to impart a revolving motion to increase the velocity; the principle is somewhat the same as that of the rifled musket barrel.

Their boomerang somewhat resembles the Australian weapon; it has an aperture where a "demon" in the shape of a pierced nut-shell is inserted. This arrangement causes a strange, ominous whistling as the weapon is hurled against the enemy, who is supposed to be very much frightened at the noise. The blowgun is one of the most dangerous and ingenious weapons ever invented by a savage, and in the hands of an expert Bakaïrian is almost a match for a modern firearm in the dense jungle.

The "projectiles" consist of the slim, tough, feather-weight arrows made from the ribs of a certain palm leaf; they are sharpened to a needle's point, but instead of being mounted with feathers they are merely wound round with a bit of raw cotton. The arrow is placed in the gun so that the cotton just fills the bore; it is blown out with sufficient force to bring down game at a distance of 250 feet, if the wind does not interfere. It is not the force of the dart that kills, but the poison with which it is saturated. A mere scratch by such a dart is invariably fatal.

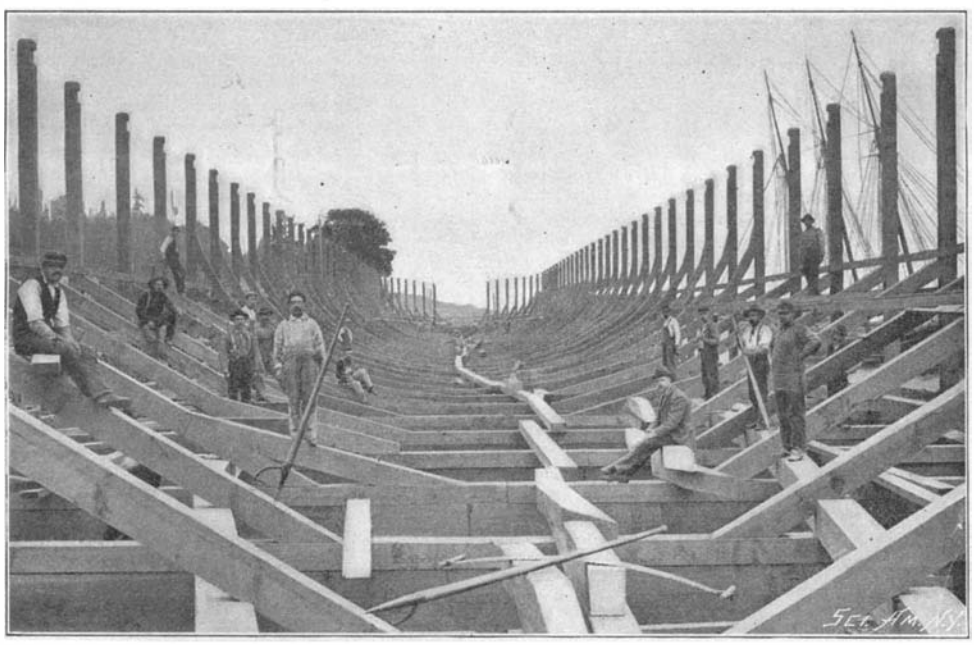
The Bakaïri tribe is famous for some very queer customs, such as the eating of earth, and the rules attending childbirth and the burial of warriors.

The rising of the River Xingo during three months of the year scatters the fish, making it impossible for the tribe to obtain any other food than the baked mud of the river, which is by no means unhealthful. This river mud is very rich in mineral substances, and while it cannot be said to contain nourishing properties to any extent, it fills the stomach and appeases hunger. It is baked in a sweltering sun, eaten in the shape of small balls about 3 inches in diameter, the average daily consumption being about three-quarters of a pound for each Bakaïri.

Like most American Indians, the Bakaïri attach a great deal of importance to tattooing, but in their case the custom owes its origin more to the necessity of averting the insects than to the device for personal adornment. The mosquitoes on the Rio Xingo are so ferocious and pugnacious that extraordinary measures must be taken against them, and when, centuries ago, it was found that a mixture of clay and vegetable oil applied to the skin would keep off the insects, the idea of mixing colors suggested itself, and then and there was the beginning made to the art of tattooing.

The language of the people is poor in words. To illustrate the poverty of the Bakaïri dialect, there is no name for "parrot," although a variety of parrot species are known by separate names. The various kinds of palm trees are designated, though no given name exists for the word "palm." "We" also means "good;" "others" (which they express by saying "not we") also means "evil." The Bakaïri can only count two; if you ask him to count on, he will continue; two-one, for three; two-two, for four; two-two one for five, etc., reminding us of the manner in which bells are struck on shipboard.

Unlike other Brazilian aborigines, the Bakaïri know nothing of intoxicating vegetable drinks. They maintain their ancient custom of shaving the top of the head with a keen-edged native grass. Early explorers supposed that they borrowed this custom from the Jesuit monks, who were the first white men to visit them, but it has been proven lately that the bald spot on the head was characteristic of the Bakaïri centuries before any white man penetrated the tropic wilds of their home.



CRADLE IN WHICH RAFT IS BUILT UP.

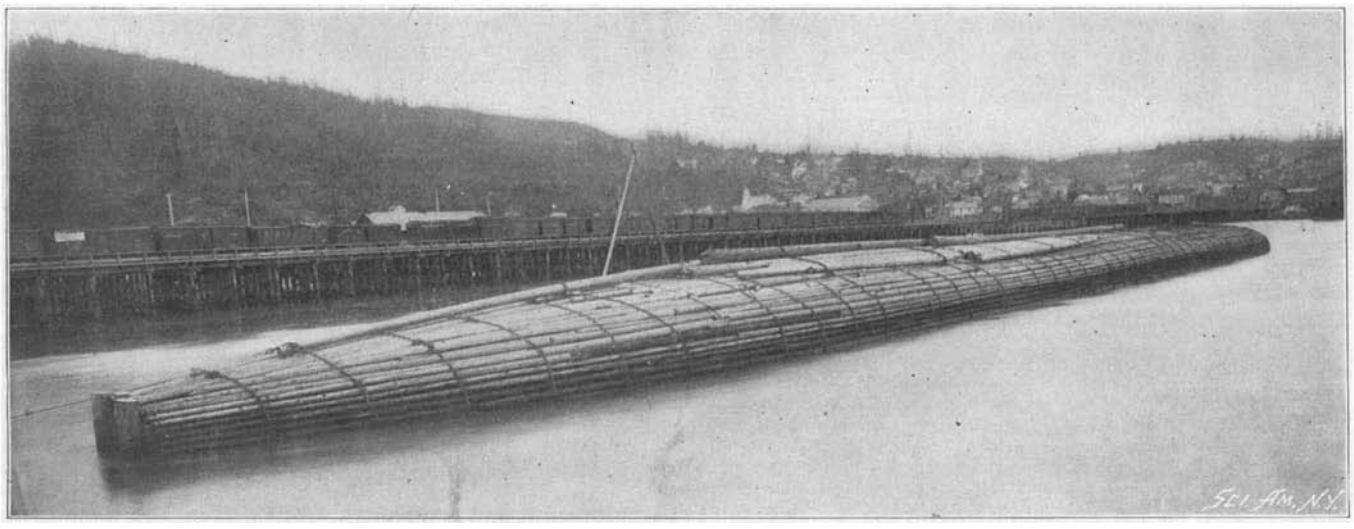
LUMBER RAFTS ON THE COLUMBIA RIVER.

The States of Oregon and Washington have seen a remarkable development of the method of transporting lumber to California by sea in the form of large built-up rafts, and although the increase in the price of timber of the kind which has been shipped by this method makes it likely that no more rafts of the kind will be built, this unique and daring means of transportation will always remain as one of the curiosities of the lumber trade of the Pacific coast. We present illustrations of the last of these large rafts to be constructed. Like several of its predecessors, it was built at the little town Stella, which is located on the Washington shore of the great Columbia River, and about twenty miles from its mouth. The accompanying illustrations are of particular interest, as showing the means by which the huge rafts are built up to the desired cigar shape, prior to their launching.

This particular raft was some 400 feet in length and over 100 feet in circumference. It was built up of fir piles, which varied from 80 to 111 feet in length. It is readily perceived that to form a strong and flexible structure of this length out of such relatively short pieces, and mould it to a true cigar shape, would be an impossible task, unless a permanent form of cradle were first built in which to contain it during the process of building it to form. The cradle, as will be seen from our illustrations, is not unlike the skeleton of a large ship in the days of wooden shipbuilding. It is constructed with a double keel and a series of heavy frames of 12 by 12 timbers with heavy knee-bracing between the floor timbers and the verticals at a point which would be known as the bilge in a ship. The keel is constructed in two sections, which are held together by massive locks or clamps, to maintain the cradle in position while the raft is being formed. The piles of the raft are laid to break joint as far as possible, the abutting ends of one line of the piles coming opposite the center of the piles adjoining.

When the raft is completed it is wrapped around several times with massive cable chains, which hold the mass firmly, but flexibly, together. After the raft is launched, the locks are sprung open by hauling upon ropes which are securely connected to them, and the two halves of the cradle, thus unlocked, float apart, leaving the raft free to be towed away. The tug's hawser for towing is made fast to a very heavy chain, which runs through the entire length of the raft. This towing chain is made fast by transverse chains to each of the binding chains, which run around the circumference of the raft. The effect of this arrangement is that when the strain of towing comes upon the central chain, the binding chains are also tightened, and, consequently, when the raft is in a sea-way, the greater the strain upon the hawser, the tighter is the clamping effect of the binding chains. Although the earlier rafts frequently came to grief, those which have been constructed of late years on the system, as outlined above, have proved themselves well able to stand the stress of an ocean trip.

The distance from the mouth of the Columbia River to San Francisco is about 700 miles, and under ordinary conditions of weather one of the powerful tugs which are detailed for the work of towing will take a raft of this kind from the Columbia bar to the Golden Gate, San Francisco, in about twelve days. The raft, which is herewith illustrated, contains about 500,000 linear feet of timber, or say about 6,000,000 board feet, a sufficient quantity of timber to load a half dozen vessels each of 1,000 tons burden.



RAFT OF PILES ON THE COLUMBIA RIVER READY FOR TOWING TO SAN FRANCISCO.

Length, 400 feet; circumference, 100 feet; contents, 6,000,000 feet board mea ure.

The Current Supplement.

The current SUPPLEMENT, No. 1287, has many papers of unusual interest. "Problems in China," is by James M. Hubbard. "China and Her People; Some Reflections Upon Their Manners, Customs, Habits, and Lives," by Commander Harrie Webster, U. S. N., is another timely article. Both are illustrated. "Peary Supply Ship Sails" describes in detail the construction and stocking of this vessel. "Old St. Peter's, Rome," is an important restoration. "The Panoramas of the Paris Exposition" describes the Balloon Cineorama at the Fair. The eighth instalment of "American Engineering Competition" is given in this number. "The Opening of the Metropolitan Railway at Paris" is fully illustrated. "The Biological Laboratory at Cold Spring Harbor, L. I.," is by W. G. Bowdoin. "Tetanus and Its Treatment," and "The Coloring of Soap and Candles," by George H. Hurst, are valuable articles. The usual Trade Notes and Consular matter will also be found in this number. "My Experience with a Siphon Pipe Line," by John K. Prather, B.S., describes a simple and convenient device.

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RECENTLY PATENTED INVENTIONS.

Industries, Manufactures, Trades, Etc.

CONSTRUCTION OF CEILINGS AND WALLS FOR BUILDINGS. — FRANZ KEMNITZ, Bayreutherstrasse 9, Berlin, Germany. The inventor has provided a new method of arranging and stretching ropes for supporting the mortar for ceilings and walls. Cramps, to which the ropes are fastened, are secured in the walling of the room. Between these cramps the ropes are arranged in a net, their ends being tightened as much as possible and finally knotted together. Upon this strong network the mortar is brought. If ceilings are to be made, a detachable boarding is arranged underneath the network, which boarding is removed after the material has hardened. By this means beton ceilings of very small thickness can be produced quickly and cheaply.

SCREEN FOR STAMP-MILLS.—MARTIN R. DRISCOLL, Frisco, Utah. This screen is so arranged that it can be changed without stopping the battery. A frame is employed having a number of apertures. Rolls of screen-cloth are mounted above the apertures. The rolls can be adjusted so as to bring their rear faces flush with the faces of the apertured frame. Clamping-frames hold the screen-cloths in front of the apertures. And an auxiliary clamping-bar receives the lower end of the cloth. When the proper clamping-frame is raised, the worn-out screen is drawn down and the clamping-frame again locked. The bottom portion of the screen is doubled over the auxiliary clamping-bar and clamped in place. By employing two screen-cloths, the operator can change one while the other is in use.

ACETYLENE-GAS GENERATOR.—THOMAS E. E. BARTLETT, Atlanta, Ga. The inventor has concerned himself chiefly with providing an efficient automatically-operating carbid-feeder. The carbid is contained in the radiating compartments of a rotary receptacle mounted above a chute leading to the generating-chamber. Each compartment is provided with a releasable bottom. As the receptacle mentioned is rotated by the rise and fall of the gasometer, the bottoms of the compartments are successively released by a trip so that the carbid drops into the water of the generating-chamber.

WEIGHT AND PRICE SCALE.—CLARK CORBIN, Carbon Cliff, Ill. The invention provides a scale for weighing commodities and indicating their cost, which scale is so constructed that the value of an article of any weight can be read (by weighing it at its price per pound) with but one line of graduations to show the value and with one line of graduations to show the price per pound.

SODA-WATER APPARATUS.—JOSEPH O. WILD, Cottage City, Mass. The sirup receptacles are circularly arranged about a central ice-receptacle and mounted upon a turn-table which can be rotated to bring the proper sirup-receptacle into view. The lower ends of the receptacles are provided with nozzles beneath which glasses are placed. Both nozzles and glasses can be concealed from view by separate doors. The entire arrangement is noteworthy for its compactness and neatness.

Mechanical Devices.

MATCHING-MACHINE.—JOHN M. KUEBLER, Wausau, Wis. This matching-machine is so arranged that the cutters can be changed while the head is in motion, that narrower or wider grooves and tongues can be cut, and that the position of the cutters can be changed to locate the groove and tongue at a different height on the board.

MACHINE FOR MOLDING AND CUTTING ICE-CREAM. — GEORGE MCC. PINKERTON, York, Penn. The machine molds and cuts ice-cream in small blocks to be wrapped in paper, the machine being of such a nature that the blocks can be so quickly and economically cut and wrapped that they can be sold at a very small cost. The machine comprises a reciprocating cutter-knife carried by guide-rods; a tilting slicer-knife provided with a crank; a trip-lever adapted to depress the crank and arranged to be tripped by the movement of the guide-rods; and spring secured to the crank so as to return the slicer-knife to its normal position.

HOISTING APPARATUS.—ROBERT WATSON and CHARLES E. STEVENSON, Nanaimo, Canada. The apparatus is designed to be used for all hoisting purposes, as a fire-escape, as a hoist in mining-shafts, as an elevator, as a painter's scaffolding, and the like. The invention consists in the provision of novel hoisting devices and in means for extending horizontally from the place of hoisting and lowering any persons or goods which are not in the vertical line of the hoisting apparatus.

TRACTION-ENGINE. — DANIEL C. CAWLEY, 1309 Park Building, Allegheny, Penn. The object of the invention is to provide a construction of truck for traction-engines by which to secure a greater bearing and tractive effect on the ground; for it is well known that sandy, muddy, and rough roads present great obstacles to motor-wagons. The invention employs the principle of the endless track-chain revolving around the truck-wheels and bearing directly on the road bed for greater frictional contact; and it provides for accommodating the various adjustments which a rough road renders necessary with such a track-chain.

WAGON-LOADING DEVICE.—LEONARD C. WOOD, Alden, Iowa. The purpose of this invention is to provide a means for loading wagons from scrapers, by which means the scrapers are lifted bodily into the wagon and dumped therein. The invention consists of a chute, a scoop, a mechanism which when engaged with the wagon axle causes the scoop to travel up the chute into the wagon.

Marine Inventions.

PROTECTIVE ARMOR FOR HULLS OF VESSELS.—ROBERT F. B. WALSH. Brooklyn, New York city. This armor protects a vessel when passing over suspected mines or torpedoes. The armor forms a false keel and slants from the keel-line upwards at the sides in opposite directions, the upper longitudinal edge of the armor being some distance from the sides of the hull. When the false keel, which is more or less sharp, strikes an explosive, the shock of the explosion will not be in a vertical direction, but will be divided and sustained by the inclined sides of the protective armor, thus preventing the hull from being blown upward out of the water.

MARINE VESSEL.—PETER U. and ANNA M. J. RIESS, Williamsbridge, Bronx, New York city. To prevent a vessel from capsizing the wooden keel-body is provided with a longitudinal recess in its under side. Against the sides of the keel-body ribs abut, which are secured by flanged irons and screws. A weight is fitted in the recess and is secured to the body independently of the ribs. A strong construction and great stability are thus secured.

LIFE-BOAT.—PETER U. and ANNA M. J. RIESS, Williamsbridge, Bronx, New York city. The hull is provided with a series of side compartments extending slightly below the water-line. A bow-compartment extends the whole length of the hull. A stem-compartment only slightly below the water-line. The bow and stern compartments are divided by longitudinal partitions. The rudder has its post mounted in the partition of the stern-compartment. The arrangement of air compartments, extending all around the hull, prevents the boat from capsizing. Even if filled with water the boat cannot sink. The arrangement described in the foregoing notice can be combined with the present construction to produce a remarkably efficient vessel.

MARINE PROPULSION.—PETER U. and ANNA M. J. RIESS, Williamsbridge, Bronx, New York city. This propelling-gear for boats comprises a propeller shaft which passes through a sleeve driven by foot-actuated gear. Between the sleeve and the propeller-shaft power-transmission gearing is arranged. The persons in the boat propel the vessel very much as they would a bicycle. Handle-bars are provided, after the pattern of bicycle handle-bars, one of which is connected with the rudder so that the boat can be readily steered.

Railway-Appliances.

NUT-LOCK. — ASA W. WEBB, South Union, Ky. The inventor has devised a novel lock for two nuts, which comprises a lock-bar having notched ends adapted to engage the inner and side faces of the nuts. The rear walls of the notches are inclined in parallel lines obliquely to the length of the bar, so that a backward turn of the nuts will bind their side faces against the rear walls. So long as the lock-bar is in place the nuts will be prevented from turning.

AUTOMATIC AIR-PIPE COUPLING. — JOHN W. SPURLOCK, Ty Ty, Ga. This inventor has provided a new automatic air-pipe coupling which is arranged to insure a positive coupling of the hose between adjacent cars at the time the latter are coupled and to allow one member of the coupling to be coupled with the member of an ordinary coupling, if the adjacent car be equipped with an ordinary coupling.

Vehicles.

VEHICLE-BRAKE.—RUBEN H. WHITE, Princeton, Ky. The brake is so arranged that it can be applied either by the team or by hand. The vehicle to which the brake is applied is propelled by the rear wheels, the draft being at the rear axle and the two trucks being rigidly connected. The team draws directly from the center of the hind axle.

TIRE AND RIM FOR VEHICLE-WHEELS.—WILLIAM F. RAE, 36 Holland Villas Road, Kensington, London, England. The wheel-rim is made of aluminium and has an outer peripheral opening, through which the tread of the solid outer tire projects, the opening being bounded by flanges projecting outwardly. The circular portion of the rim is of a single thickness, the flanges being formed by bending the edges of the metal outward and then inward upon themselves, so that the portions of the flanges which are outside the rim are of double thickness of metal and the portions inside the rim, forming shoulders therein, are of single thickness. Thus a rim is produced combining maximum lightness and strength.

Miscellaneous Inventions.

WATCHMAN'S REGISTER. — JOHN A. DEMUTH, Oberlin, Ohio. This invention is arranged to compel a watchman regularly to visit various points within his precinct and show any irregularity in his work. By furnishing a double check on his visits the chance of fraud is eliminated. A novel feature of the register is that it need never be set or visited by any person other than the watchman, who can wind the clockwork without being able to tamper with the mechanism. It is also useful as an employé's time register.

CHURN.—CHARLES W. BOWLING, Fulton, Mo. The purpose of the invention is to provide a churn-dash so constructed that it can be readily cleaned or turned either way. The dash both agitates and aerates. When the dash is in operation, which will cause a partial vacuum to be formed at the bottom portion of the body of the dash, the air rushing in at the upper portion of the body of the dash passes downward and causes the milk or cream to be aerated while agitation is in progress, thereby combining two forces, either of which will cause the butter to be separated from the cream, but which when combined produce much better cream.

IMPLEMENT FOR EXTRACTING CARTRIDGE-SHELLS. — PETER BERGERSEN, Cheyenne, Wyo. By means of this implement, headless or broken shells are quickly extracted from a gun-barrel through the action of the ejector or extractor constituting a part of the fire-arm. A supplementary extractor is provided which can be quickly introduced into a broken or mutilated shell and which can be so engaged with the muzzle of the cartridge that the shell and supplementary extractor will be simultaneously withdrawn. The supplementary extractor is provided with an expanding member having a flange adapted to be engaged by the main extractor of the arm, which flange acts as a substitute for a missing head.

EDUCATIONAL GAME.—JAMES R. HUGHES, Bellefonte Academy, Bellefonte, Penn. To provide a means for teaching Latin conjugations in a simple and impressive manner, so that even dull pupils will learn verbs, Mr. Hughes has devised an ingenious game which he calls "Railroading Through Latin Verbs." The game includes a "Verb Station" and four gates leading to as many tracks, each gate and its track being named after one of the principal parts of a Latin verb. At intervals along each track are arranged small stations representing the several tenses derived from the principal parts of the verb, the active voice being placed on one side of the track and the passive voice on the other. The game is to be played by spinning an indicator, which, stopping at the name of a certain tense, calls for the pupil to take a mannikin representing a tense, to place it on the proper car, so that it will reach the proper station.

ROUTING TABLE AND CASE FOR POST-OFFICES.—MARCELLUS S. FIELD, Office of Sup't of Delivery, Boston Post-Office, Mass. The table requires no more lighting than the ordinary desk and can be readily equipped with fixtures without interference with its maximum case elevation, even though loaded with "Long Tom" letters. The lower shelves may be drawn forward, which feature, together with the vertical shelf motion, affords great convenience in routing letters. The desk furnishes each carrier with 6 square feet of table area. The use of additional tables with illuminating fixtures for arranging papers is obviated, and consequently the expense of lighting is reduced to a minimum and the overcrowding of offices with unnecessary furniture is avoided. The concentration of the entire work on one desk is of great advantage, especially when substitutes are performing temporary service. The desk is now in practical use at four Massachusetts post-offices.

HORSESHOE-PAD.—JACOB KRONENBERG, Brooklyn, New York city. The pad has a raised rear or heel portion, the lower face of which is provided with suction-cups. When the horse plants his foot down, the higher rear portion is first compressed, so that the suction-cups come immediately into action to insure a secure hold of the pad on the roadbed. The cups take the place of the ordinary heels of the shoe now used.

GARMENT-FASTENER.—FANNIE B. MATHEWSON, Manhattan, New York city. This hook and eye is secured by barbs which enter the garment, thus avoiding sewing. One of the securing devices of the eye is hook-shaped and provided with a guard. The hook member of the fastener, in addition to its securing barbs, has a sleeve-like receiver at the back, which receives a common pin. The ease of application is the chief merit of the device.

CONVERTIBLE TUB. — RICHARD W. LEVY and JOSEPH HOLT, Paterson, N. J. This tub comprises two sections separable from each other. A bottom is secured to one of the sections and has a segmental portion extending beyond the ends of the section and adapted for engagement with the other section. The parts are so disposed that they can be converted either into a wash-tub or a bath-tub, the change being effected by the removal of one section and the substitution of another. A watertight locking device is provided for the sections.

SHOE-FASTENER. — DAN M. YOUNG, Newburg, N. Y. The inventor has devised a fastener arranged to enable the shoe to be conveniently and quickly opened so that it can be slipped on the foot, and to be closed simply by pulling the string or lace without first lacing as heretofore.

APPLIANCE FOR SECURING COVERS OF CULINARY VESSELS IN CLOSED POSITION.—JOHANN WEIDNER, Amberg, Bavaria, Germany. The appliance secures the covers of culinary vessels, whether for boiling, steaming, or roasting, in closed position. The appliance is of simple construction and so arranged that it can be readily applied to any kind of culinary vessel with a projecting rim or top.

SCAFFOLD-HANGER.—JOHN F. BARRON, Rumford Falls, Me. The bottom of the hanger consists of adjustable sections; and to the bottom sides are hinged, pivotally connected at their ends, one of the sides being arranged to be lengthened or shortened. The hanger enables the workmen to level the scaffold. The hangers can be readily moved to any desired point in the length of the platform and are completely independent of the cross-beams of the platform.

POCKET-KNIFE.—JAMES H. CABLES, Thomaston, Conn. This pocket-knife embodies a knife-blade, a fork, and a spoon, so that it constitutes an instrument which can be readily carried in the pocket and used in camp.

Designs.

ENGINE-FRAME. — HENRY V. A. PARSELL, JR., and ARTHUR J. WEED, Manhattan, New York city. The base of the frame has pyramidal supports at each end, with a depressed central portion, and parallel braces extending from one pyramidal support to the other. The frame is noteworthy for its rigidity and strength.

NOTE.—Copies of any of these patents can be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

AIR, WATER, AND FOOD FROM A SANITARY STANDPOINT. By Ellen H. Richards and Alpheus G. Woodman. New York: John Wiley & Sons. 1900. 8vo. Pp. 230. Price $2.

The authors who can speak with authority deal with three essentials for healthful human life. Sanitary chemistry deals with these three commodities in their relation to the needs of daily existence. A larger portion of the problems of public health come under these heads. The pages deal chiefly with such portions of the subject of sanitary chemistry as come under individual control. The book is an admirable and scholarly treatment of the subject.

THE LEATHER WORKERS' MANUAL. By H. C. Standage. London: Scott Greenwood & Company. New York: D. Van Nostrand Company. 1900. 8vo. Pp. 163. Price $3.50 net.

A good book on this subject has been much needed. Leather formulas have been hard to obtain and notoriously unreliable. It deals with blackings, polishes, glosses, renovators, harness blackings, compositions, soaps, leather grinders' supplies, dyes and stains for leather. It is a very valuable book and is an eminently satisfactory contribution to technical literature.

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Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(7943) G. W. K. writes: In our water works system the reservoir is said to be 195 feet above the pump and lower ends of the town. The gage at the pump shows 85 pounds when pump is at rest; at work 115 to 125 pounds: Query.—With reservoir full and free communication through all the mains to reservoir and to city, will a gage in the main on lower levels near the end of system, indicate a higher pressure with pump running than when at rest? Water company asserts that a much better or more forcible stream at fire nozzle will be developed with the pump running than not running. My opinion is that the pump will be only useful in keeping up supply in reservoir. A. The difference in pressure when the pump is standing or running shows the amount of water friction in the pipe line between the pump and reservoir. If the town supply is taken from the pump line, the increased pressure by the gage at the pump will be felt in all parts of the distributing system in proportion to the frictional difference of the whole length between the pump and reservoir and the length from the pump to the point of connection with the town supply. Under such conditions the running of the pump will increase the force of the fire streams.

(7944) S. L. W. writes: 1. I have a United States storage battery that I charge with the eight-light dynamo described in your SUPPLEMENT. I charged the battery and used it one day, but did not use the charge all out, as I wanted to use it the next morning. I tried to charge it again, but when I connected it to the motor it would not run. I tried to charge it again, but without success. I would like to know what the matter is. A. It appears as if you had connected the dynamo wrongly in the battery when you tried to charge it, and so discharged it in place of charging it. 2. How can you tell the positive and negative poles on a dynamo? I would like to find the positive and the negative pole on my eight-light machine. A. You would better buy a pole detector. These can be had through electrical supply houses. See our advertising columns. 3. Can you tell me where I can get the spring motor of a clock. Name some firms that make spring motors. A. We do not know any spring motor on the market.

(7945) I. B. A. writes: I have been thinking that for a small number of 'phones in towns where it would not pay to have a central station the Morse telegraph alphabet could be used as a call, using the bell as sounder; with it a great number of combinations could be made. I do not know that I have ever read of its being used. If you think it would be practicable, you might mention it in your paper. A. The only difficulty in carrying out this suggestion lies with the users of the telephones. They must learn the Morse alphabet.

(7946) A. H. C. writes: Some time ago I noticed an inqury from some one who wished to know if the small dynamo described in SUPPLEMENT No. 161 would ignite a gas engine. Having recently tried one on my gasoline launch I think some of your readers would be interested in learning how it worked. By using a spark coil in the circuit it works to perfection. I can readily start engine without using the battery. If the engine has closed circuit sparking device the dynamo connected in series will ignite it, and the shunt connection if open circuit; mine works well either way.

(7947) J. J. V. writes: I made some observation of the so-called "Hertzien" waves and having seen no account anywhere of what I am to describe, I take the liberty to give you the facts. We have a series path-line in our village running in the shape of a horse shoe, and there are eight telephones in the circuit. I have noticed that during thunder storms the bells ring, sometimes more than one stroke, simultaneously with a lightning flash that was at least one mile away from the line, at a right angle to it. I have three wires running into my office; the incoming line, the outgoing line and

the ground wire. They pass through one hole in the window frame and are insulated with two layers of cotton each. Whenever there is a lightning flash two or three miles away, perpendicular to the line, there is a flash between the wires where they pass through the window frame, as often and as quick as the lightning flash follows. The sound is usually heard a little later. I think the waves strike the wire and when they get near the ground wire they jump to that and pass down into the ground. We have little or no induction in our line and that is due to the fact, I suppose, that the two ends of the line are not more than one-quarter mile apart, although the whole line is about one mile long.

(7948) T. W. B., Jr., asks: Will you please give me directions for making a frictional electric machine which will give about 12 inch spark? A. We do not think you can get a spark 12 inches long from a friction machine. We never saw one that would give such a spark. A static machine will give a spark of that length. It may be either of the Wimshurst, or of the Toepler-Holtz form. In SUPPLEMENT Nos. 278, 279, 282, 548, 647, 914, price 10 cents each, are articles describing various machines of this sort. From these you can make your plans. We have no description of a machine giving a spark of 12 inches in length.

(7949) H. P. asks: How should soda ash be inserted and in what quantities to remove scale in two 90 horse power horizontal tubular steam boilers? A. Soda ash for boiler incrustation may be pumped in with the feed water about ¼ pound per horse power of the boiler, and left in for a day when the boiler should be blown out and cleaned out. A smaller quantity may be used if applied every week for two or three weeks and the boiler then cleaned out.

(7950) J. G. R. asks: 1. How many pounds of No. 30 cotton covered wire would I need to make an induction coil 18 inches long, 9 inches diameter 2-inch core, allowing about one-sixteenth of an inch between layers for insulation? A. We could calculate the weight of wire required for the coil as specified, but it would be time poorly spent, as it would be to make a coil on these lines. No one should use wire courser than No. 36 for a coil of this size. Nor should it be wound in layers, but in sections, with much less than one-sixteenth of an inch of insulation between the layers in the sections. 2. How many square feet of tin foil would it need for a condenser? A. We cannot tell. 3. If properly made what size spark ought it give? A. It might give 6 to 8 inches, but would soon perforate the insulation, and break down. You would far better get SCIENTIFIC AMERICAN SUPPLEMENT, No. 1124, price ten cents, and make a six-inch coil properly designed. It will give more satisfaction.

TO INVENTORS

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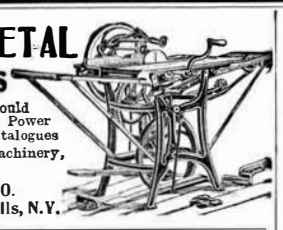

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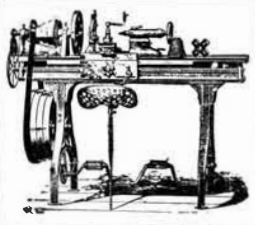

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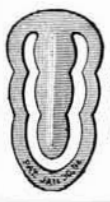

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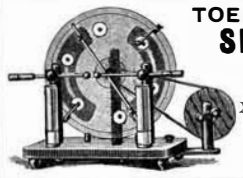

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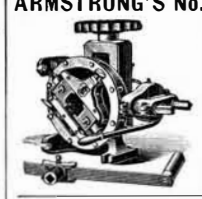

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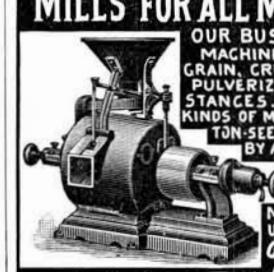

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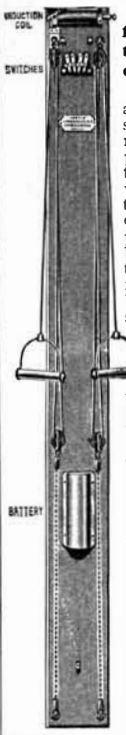

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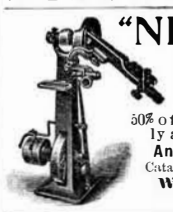

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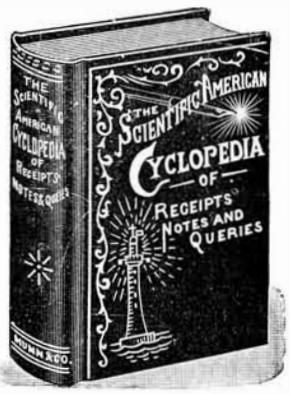

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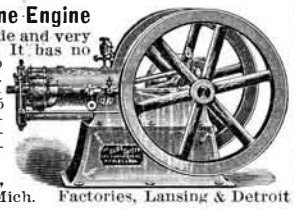

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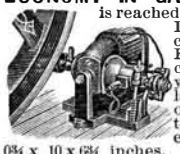

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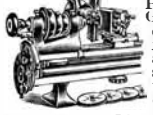

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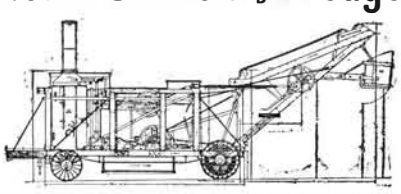

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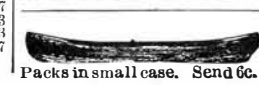

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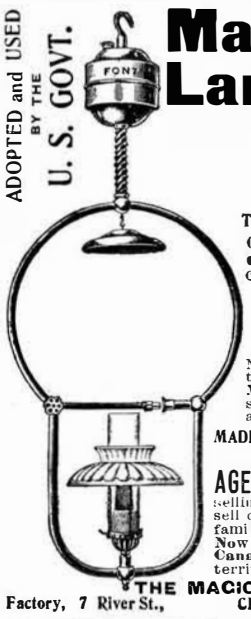

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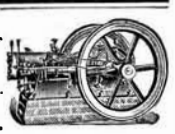

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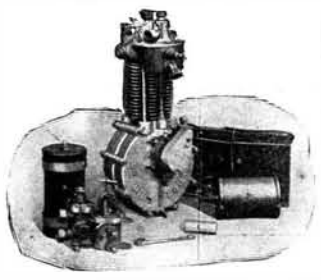

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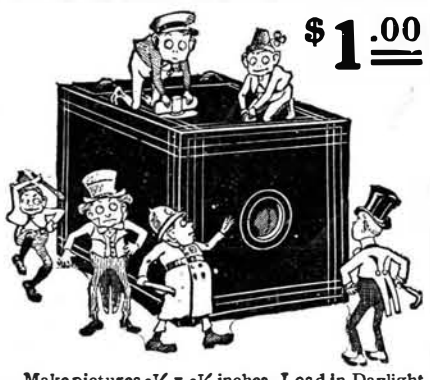

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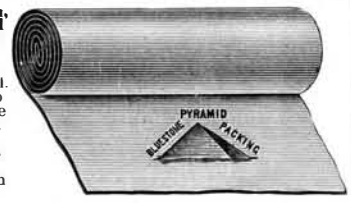

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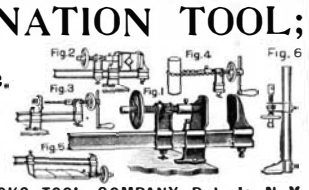

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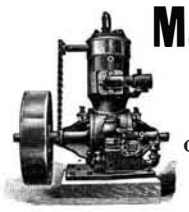

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